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OCT 31 1922

## The Engineer

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PUBLIC NOTICES

**The High Commissioner** for India is prepared to receive TENDERS for the SUPPLY of :—

1. PLATES, COPPER, for LOCOMOTIVE FIRE-BOXES.
2. TUBES, BOILER, BRASS.
3. PILLAR WATER CRANES.
4. TYRES, STEEL, for ENGINES and TENDERS.
5. CRANE, ELECTRIC, JIB, and CRANE, ELECTRIC, OVERHEAD.
6. BUFFERS, JONES' PATENT, BUFFERS, ORDINARY and SOCKETS.
7. TUBES, BOILER, STEEL, SOLID DRAWN.
8. SHEETS, MILD STEEL, GALVANISED, CORRUGATED.

Forms of Tender may be obtained from the Director-General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, and Tenders are to be delivered at that office not later than Two o'clock p.m. on Friday, the 27th October, 1922, for Nos. 1 to 3, on Tuesday, the 31st October, 1922, for No. 4, and on Friday, 3rd November, 1922, for Nos. 5 to 8.

T. RYAN,
Director-General.
500

**The Institute of Physics.**

APPOINTMENTS REGISTER AND REGISTER OF CONSULTING PHYSICISTS.

The Appointments Register Committee is prepared to recommend to Public Departments, Universities and Colleges, Directors of Research, Manufacturers, and others desirous of employing or consulting fully qualified Physicists, suitable persons possessing special knowledge of any branch of physics.

By Order of the Board,
F. S. SPIERS,
Secretary.
.0, Ea.t-street,
London, W.C. 2.
488

**Borough of Kingston-upon-THAMES.**

TECHNICAL INSTITUTE.

WANTED IMMEDIATELY, for Evening Classes, an INSTRUCTOR or INSTRUCTORS in ELECTRICAL ENGINEERING and ELECTRICAL INSTALLATION, four nights per week.

Salary at the rate of 10s. per hour for the first two hours, and at the rate of 5s. per hour for any period exceeding two hours. The same Instructor for the four evenings would be preferred, but applications for one or more evenings will be considered.

Forms of application may be obtained from the undersigned.

H. T. ROBERTS, B.A.,
Education Secretary.
501

**Bengal-Nagpur Railway Company, LIMITED.**

The Directors are prepared to receive TENDERS for the following :—

5 DECK SPAN GIRDER BRIDGES, 100ft. Span.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 9th October, 1922.

A fee of £1 1s. will be charged for the specification, which will not be returned.

Tenders must be submitted not later than Noon on Thursday, 19th October, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
T. R. WYNN,
Managing Director.
496

**Bombay, Baroda, and Central INDIA RAILWAY COMPANY.**

The Directors are prepared to receive up to Noon on Wednesday, 8th November, TENDERS for the SUPPLY of :—

LOCOMOTIVE TANK ENGINES.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 20s. each, which will not be returned.

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices : 91, Petty France,
Westminster, S.W. 1.
10.10.22.
505

**East Indian Railway.**

The Directors are prepared to receive up till Eleven o'clock a.m. TENDERS for the SUPPLY of :—

(1) FILES.
(2) PICKS, SHOVELS, &c.,
(3) GIRDER BRIDGES,

for Nos. 1 and 2 on Wednesday, the 25th October instant, and for No. 3 on Wednesday, the 1st November proximo.

Copies of the specifications can be obtained at the Company's offices on payment of £1 1s. each. This fee will not be returned.

G. E. LILLIE,
Secretary.

73-76, King William-street,
London, E.C. 4.
11th October, 1922.
522

**Kent County Council.**

LENHAM SANATORIUM.

The Sanatorium Committee invite APPLICATIONS from contractors who are prepared to TENDER for the SUPPLY and ERECTION of ELECTRIC GENERATING PLANT, comprising Oil Engines, Dynamos, Switchboard, Battery; also ALTERATIONS and ADDITIONS to ELECTRIC LIGHTING, HEATING, HOT WATER SUPPLY, LAUNDRY and STEAM PLANT; and the ERECTION of NEW BUILDINGS for PLANT, with ALTERATIONS to EXISTING BUILDINGS.

Any person desiring to Tender and to receive a copy of the plans and specification must make application to the Consulting Engineer, Mr. T. J. R. Kiernan, B.Sc., M. Inst. C.E., 17, Victoria-street, Westminster, S.W. 1, not later than 10 a.m. on Saturday, October 21st, 1922, up to which time they may be inspected at that address during the hours of 10 a.m. and 4 p.m. (Saturday and Sunday excepted).

A limited number will be selected from those applying, to whom the plans and specification will be sent in due course.

The Committee do not bind themselves to accept the lowest or any Tender, and acceptance of a Tender is subject to the approval of the Ministry of Health.

T. J. R. KIERNAN,
Consulting Engineer.
17, Victoria-street, S.W. 1,
October 11th, 1922.
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PUBLIC NOTICES

**London County Council.**

TENDERS are INVITED for the MANUFACTURE, SUPPLY and ERECTION of CONTROL PANEL and SWITCHGEAR CONNECTIONS for No. 4 Generator at Greenwich Power Station.

The specification, form of Tender and general conditions may be obtained from the Clerk of the Council, County Hall, Westminster Bridge, S.E. 1 (Room No. 215), upon payment to the Cashier of the Council of a deposit of £2. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Particulars of the work may be obtained on application at the County Hall before the payment of the fee.

Tenders must be addressed to the Clerk of the Council and delivered at the County Hall, Westminster Bridge, S.E. 1, not later than 4 p.m. on Monday, 6th November, 1922. No Tender received after that time will be considered.

The Council does not bind itself to accept the lowest or any Tender.

JAMES BIRD,
Clerk of the London County Council.
503

**Selby Urban District Council.**

The above-named Council invite TENDERS for the ERECTION of a GIRDER or FERRO-CONCRETE BRIDGE.

Plans and specifications to be sent in by contractors.

The Council do not bind themselves to accept the lowest or any Tender or Design.

Particulars may be obtained at my office.

BRUCE GRAY, A.M.I.C.E., F.R.S. (Edin.),
Council Offices, Selby.
P6235

**The Great Indian Peninsula RAILWAY COMPANY.**

The Directors are prepared to receive TENDERS for the SUPPLY of the following STORES, namely :—

| No. | | Fee for Specification. |
|---|---|---|
| 1. | ELECTRIC INCANDESCENT LAMPS.. | 5s. |
| 2. | PAINTS, DRYSALTERIES, &c. | £1 |
| 3. | GALVANISED CORRUGATED SHEETS, &c. | 10s. |
| 4. | AXLE-BOXES for CARRIAGES and WAGONS | 5s. |
| 5. | ACID OPEN-HEARTH STEEL BOILER PLATES | 5s. |
| 6. | WHITE COTTON TAPE | 7s. 6d. |
| 7. | SPARE PARTS of CARRIAGES and WAGONS (SIDE and END DOORS) . | 10s. |
| 8. | WHITE LEAD | 10s. |
| 9. | SCREW JACKS, &c. | 5s. |
| 10. | LINOLEUM | 10s. |
| 11. | ROPES, TWINES, &c. | 5s. |
| 12. | PLATE GLASS, &c. | 10s. |
| 13. | SPRING STEEL | £1 |
| 14. | CANVASES, &c. | 10s. |
| 15. | COPPER PLATES, RODS and INGOTS | £1 |
| 16. | ROLLED STEEL DISC WHEELS and AXLES for CARRIAGES and WAGONS | 10s. |

Specifications and forms of Tender may be obtained at this office on payment of the fee for the specification, which payment will not be returned.

The fee should accompany any application by post. Cheques and postal orders should be crossed and made payable to the Great Indian Peninsula Railway Company.

Tenders must be delivered in separate envelopes, sealed and addressed to the undersigned, marked "Tender for Electric Incandescent Lamps," or as the case may be, not later than Eleven o'clock a.m. on Tuesday, the 24th October, 1922.

The Directors do not bind themselves to accept the lowest or any Tender.

R. H. WALPOLE,
Secretary.

Company's Offices,
48, Copthall-avenue, E.C. 2,
London, 11th October, 1922.
523

PUBLIC NOTICES

**Siam.—Department of State RAILWAYS.**

NOTICE.

TENDERS are INVITED for the SUPPLY of RAILWAY STORE MATERIALS.

Specifications, drawings and Tender forms may be obtained against payment of £2 12s. from Messrs. C. P. Sandberg, 40, Grosvenor-gardens, London, S.W.1.

Sealed Tenders, with the inscription "Tender for the Supply of Railway Store Materials, 2465," must be forwarded to the undersigned, at whose office in the City of Bangkok, Siam, they will be received up to 2 p.m. on 31st day of January, 1923, at which place and hour the Tenders will be publicly opened.

Right is reserved to reject any or all Tenders and to accept any Tender which, in the opinion of the undersigned, is to the best interests of the Siam State Railways.

GENERAL PURACHATRA,
Commissioner-General.
Department of State Railways,
Bangkok, 28th August, 1922.
524

**Wycombe Rural District Council.**

STOKENCHURCH WATER SUPPLY.

CONTRACT 4.

ERECTION OF COMBINED WATER TOWER, ENGINE-HOUSE AND STORE-ROOM.

TENDERS are INVITED for the ERECTION of a REINFORCED CONCRETE WATER TOWER with SERVICE TANK of 10,000 gallons capacity, ENGINE-HOUSE and STORE-ROOM. Reinforcement to be supplied by the Indented Bar and Concrete Engineering Co., Ltd., and fixed to their design.

Specification, form of Tender, and other information may be obtained from the Consulting Engineers, Messrs. Lucas and Pyke, 30, Victoria-street, Westminster, S.W. 1, on payment of a fee of £1, which will be returned on receipt of a bona fide Tender.

Tenders, endorsed "Stokenchurch Water Supply, Contract 4," should be addressed to the undersigned, in a sealed envelope, on or before 26th October, 1922.

The Council do not bind themselves to accept the lowest or any Tender.

B. L. REYNOLDS,
Clerk to the Council.
High Wycombe, Bucks,
12th October, 1922.
P6254

**Metropolitan Borough of STEPNEY.**

ELECTRICITY SUPPLY.

PLANT FOR SALE.

The above-named Council have FOR DISPOSAL the following PLANT :—

ONE 1000 K.W., 180 lb. pressure, 1500 r.p.m. PARSONS' TURBINE, coupled to TWO 500 K.W. DIRECT-CURRENT GENERATORS, 250 volts, each fitted with Three-phase Alternating-current Slip Rings and complete with Contraflo Condenser, Motor-driven Circulating Water Pump and Spares, including Spare Armature for Generators.

ONE 1500 K.W., 180 lb. pressure, 1500 r.p.m. PARSONS' TURBINE, coupled to 1750 kilovolt ampere, 6600 volts, 50 cycles, THREE-PHASE ALTERNATOR with EXCITER, together with Contraflo Condenser and Motor-driven Circulating Water Pump and Edwards' Air and Condensate Pump.

ONE TURBO-ALTERNATOR, similar to the above, but with Willans and Robinson REACTION TURBINE.

The plant can be inspected at any time and, by arrangement, can be seen running. Further particulars can be obtained on application to the undersigned.

The plant is offered in its present condition and without guarantee, and offers will be considered for any one of or all of the above plants.

The Council do not bind themselves to accept the highest or any Tender.

WM. C. P. TAPPER,
Engineer and Manager
27, Osborn-street,
Whitechapel, E. 1,
9th October, 1922.
517

PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
STEAM TURBINES.

**The Proprietors of British Letters** PATENT No. 117,768 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It comprises improvements in the construction and arrangement of the stator and rotor buckets in circular flow type turbines.

Address : B., W., & T.,
111/112, Hatton-garden,
494 London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
MACHINE FOR MAKING BOXES.

**The Proprietors of British Letters** PATENT No. 13,346 of 1915 are PREPARED to SELL the PATENT or to LICENSE British Manufacturers to work under it. It relates to a machine for making boxes of paper and thin wood.

Address : B., W., & T.,
111/112, Hatton-garden,
518 London, E.C. 1.

**County Borough of Halifax.**

ELECTRICITY DEPARTMENT.

The Tramways and Electricity Committee of the Halifax Corporation have FOR SALE the following :—

2 BABCOCK and WILCOX WATER-TUBE BOILERS, complete with CHAIN-GRATE STOKERS.

The above-mentioned boilers may be inspected at the Corporation's Power Station, Foundry-street, Halifax, by arrangement, and full particulars obtained on application to Mr. W. M. Rogerson, M.I.E.E., Borough Electrical Engineer, 29, Northgate, Halifax.

Tenders for the above plant should be delivered to the Town Clerk, Town Hall, Halifax, not later than Saturday, November 4th next.

The highest or any Tender not necessarily accepted.

By Order,
PERCY SAUNDERS,
Town Clerk.
Town Hall, Halifax,
6th October, 1922.
483

**Bombay Port Trust.**

ENGINEERING ASSISTANT.

The Trustees of the Port of Bombay REQUIRE the SERVICES of an ENGINEERING ASSISTANT, with good experience of Girder, Bridge, and Roof Steel Work Design, Building Construction, and Heavy Masonry Work. Should preferably have obtained experience in connection with railway or dock work, and have been some time with a good contractor. Capable of preparing designs and drawings and making calculations under the direct supervision of an Executive Engineer. Salary Rupees 850 per month, rising annually by Rupees 30 per month to Rupees 940, and, if married, with such married officers' house allowance as he may be eligible for under the rules of the service. Three years' agreement.

Applications, in writing only, stating age, education, technical qualifications, &c., with copies of testimonials, to the CONSULTING ENGINEERS, Bombay Port Trust, 2, Queen Anne's-gate, Westminster, S.W. 1.
P6253

**County Borough of Burton-UPON-TRENT.**

BURTON BRIDGE WIDENING.

WANTED AT ONCE, DRAUGHTSMAN, with experience of Ferro-concrete Bridge Work; also CLERK of WORKS.

Apply before Wednesday, the 18th instant, stating age, experience, and salary required, and enclosing copies of three recent testimonials to

GEORGE T. LYNAM,
Borough Engineer and Surveyor.
Town Hall, Burton-on-Trent,
9th October, 1922.
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SITUATIONS OPEN

WANTED, ASSISTANT ENGINEER MANAGER for Cement Works abroad; knowledge of Cement Manufacturing essential. Good pay and prospects to right man.—Write, giving particulars of experience and stating salary required, age, married or single, &c., to "CEMENT," c/o Street's, 30, Cornhill, E.C. 3.
515 A

WANTED by Lancashire Engineering Firm, Experienced RATE FIXER, capable of Taking Charge of Introduction of System of Payment by Results into their shops, Manufacturing Large Steam Engines and Heavy and Light Millwrights' Work.—Address, stating experience, age, and salary required, 508, The Engineer Office.
508 A

ASSISTANT COMMERCIAL MANAGER REQUIRED for Branch Office in India; must have experience in Sales, Estimates and Correspondence; unmarried preferred.—Apply by letter, stating salary required and experience, to the CAMPBELL GAS ENGINE CO., Ltd., Halifax, Yorkshire.
509 A

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## SITUATIONS OPEN

ASSISTANT ENGINEER and CHIEF DRAUGHTSMAN combined REQUIRED for Works in East of London. Thorough theoretical and practical general mechanical experience required. A good salary will be paid to a suitable man.—Address, with full particulars, stating age, experience, and salary required, P6224, The Engineer Office. P6224 A

ENGINEER REQUIRED by London Firm of Heating Engineers; must be capable of Designing and Supervising during Erection Heating and Ventilating Plants of all descriptions.—Address, in confidence, full particulars, salary, &c., P6257, The Engineer Office. P6257 A

INDIA.—ASSISTANT MANAGER REQUIRED for important Ca e and Wagon Shop; must have shop and drawing- ce experience with good firm of Railway Carriage Wagon Builders. Conversant with modern shop practice and able to control men. Age not over 33 years. Excellent opening for good man.—Write, with full details of experience and copies of testimonials, to Z. A. 755, care Deacon's, Leadenhall-street, London. 504 A

FIRST-CLASS TRAVELLER REQUIRED by Firm of Engineers opening an office in Liverpool. Must have good connection amongst shipping engineers in Liverpool and district and amongst firms in Lancashire and Yorkshire. State experience and lines travelled in, also salary required.—Address, 432, The Engineer Office. 432 A

THE STANTON IRONWORKS COMPANY, Limited, near Nottingham, REQUIRE for their Holwell Works a fully qualified ENGINEER for Supervising the Maintenance and Operation of the Plant (Blast-furnaces and Foundries); a liberal salary will be paid.—Apply to the SECRETARY at the above address. 527 A

WANTED AT ONCE, Good DRAUGHTSMAN for Temporary Work in Railway Engineer's Office in London. Salary according to experience.—Address, 521, The Engineer Office. 521 A

WANTED IMMEDIATELY in London, JUNIOR TRACER.—Address, stating age, experience, salary expected, and when free, P6258, The Engineer Office. P6258 A

DRAUGHTSMAN WANTED for Constructional Engineer's Offices in Midlands; must be well acquainted with and able to produce Stress Diagrams quickly. State age, wages, when disengaged, and fullest particulars.—Address, 510, The Engineer Office. 510 A

EXPERIENCED MECHANICAL DRAUGHTSMAN, capable of taking own measurements without supervision, REQUIRED for Factory Drawing-office in the East of London.—Address, stating experience, age, and salary required, 525, The Engineer Office. 525 A

FIRM on East Coast REQUIRES SENIOR DRAUGHTSMEN for Aircraft Design. Applicants must have had a good technical training and be quick and accurate draughtsmen. Previous aircraft experience desirable, but not essential. State age, experience, and salary required, and when at liberty to commence duties.—Box 319, W. S. Crawford, Ltd., 239, High Holborn, London, W.C. 1. 497 A

FIRST-CLASS DRAUGHTSMAN REQUIRED, with previous experience in the Design, Lay-out, and Arrangement of Diesel Engines.—Address, stating age and experience, together with salary, 520, The Engineer Office. 520 A

FIRST-CLASS DRAUGHTSMAN WANTED for Structural Steel Works in S.W. London; conversant with L.C.C. requirements; able to take work through, quick and reliable. State age, experience, salary required, and when free. Permanency to suitable man.—Address, 535, The Engineer Office. 535 A

FIRST-CLASS DRAUGHTSMAN WANTED, Experienced in Designing and Detailing all classes of Steam and Electric Cranes.—Apply by letter, stating age, experience, and salary, to THOMAS SMITH and SONS (Rodley), Ltd., Steam and Electric Crane Works, Rodley, near Leeds. 482 A

HEAD DRAUGHTSMAN WANTED AT ONCE by Firm of Electric Lift Makers, to Take Entire Charge of Drawing-office. Must be thoroughly conversant with every detail of modern Electric Lift Design and Construction and with up-to-date drawing-office practice and routine. Only gentlemen who have had long and specialised experience in similar work will be considered.—State age, experience, salary required, when at liberty, and any other particulars, and apply to R. A. EVANS, Ltd., Electric Lift Makers, Prospect-road, Leicester. P6255 A

LEADING DRAUGHTSMAN REQUIRED, to Take Charge when chief is away; Gasworks Plant, Conveyors and Elevators. Other than real live men should not waste their time applying. State age, experience, and salary required.—Address, P6229, The Engineer Office. P6229 A

MILLWRIGHT WANTED for London, Experienced and practical man, able to maintain Grinding Mills of all descriptions in manufacture of high-class Paints and Enamels.—Write, giving particulars previous experience and wages required, to Z. K. 607, care Deacon's, Leadenhall-street, E.C. 2. 536 A

## SITUATIONS WANTED

WANTED, OPENING for College and Works Trained STUDENT (21), G.I. Mech. E. One presenting ultimately commercial work, London district preferred.—Address, P6178, The Engineer Office. P6178 B

A.M.I.C.E., 14 Years' Experience on Important works, DESIRES responsible POST as CONTRACTOR'S AGENT or RESIDENT ENGINEER. Practical knowledge of steel erection, also foundations, workshop buildings and railway work.—Address, P6249, The Engineer Office. P6249 B

BOILERMAKER, Practical Experience, Boiler Inspection and testing, boiler design, electric and acetylene welding and burning, REQUIRES SITUATION.—Address, P6246, The Engineer Office. P6246 B

BUYER.—The MANAGER of a Large Engineering Works Purchasing Dept., who has an exceptionally wide knowledge of the markets of the country, DESIRES to NEGOTIATE NEW APPOINTMENT.—Write, Z. M. 613, c/o Deacon's, Leadenhall-st., E.C. 467 B

ENGINEER, A.M.I.C.E., with University Degree, DESIRES POST; 16 years' experience, including furnaces, gas producers, &c., and structural steel work.—Address, P6239, The Engineer Office. P6239 B

ENGINEER (37), Chief Engineer's Certificate, 7 years' practical experience in Far East with rubber, tin mining and dredging, sugar refining machinery and travelling, SEEKS APPOINTMENT as Travelling Representative. Well introduced to buyers; open to offer on salary or commission basis. Excellent references.—A.W.S., 30, Dordrecht-rd., Acton Vale, W.3. P6225 B

ENGINEER DESIRES APPOINTMENT Abroad; lately engineer and works manager for large chemical works in Glasgow, 7 years responsible engineer's position in Argentine, 7½ years engineer at large gas and constructional engineers in England; speaks Spanish.—Address, P6227, The Engineer Office. P6227 B

ENGINEER, 20 Years' Exp., Shops, D.O., Commercial, charge of plant, lean, int. comb., and electrical, A.M.I. Mech. E., 1st class B.O.T. cert., excellent references, SEEKS responsible POSITION.—Address, P6228, The Engineer Office. P6228 B

ENGINEER (25), B.Sc. Hons. Eng., Grad. I.E.E., 4½ years power station, 2 years research, DESIRES APPOINTMENT as Assistant in Research, manufacturing firm, power station, or traction.—Address, P6194, The Engineer Office. P6194 B


# Edward Arnold & Co.'s Book List.

## RAILWAY ELECTRIC TRACTION.

By F. W. CARTER, M.I.E.E.

British Thomson-Houston Company, Rugby. 400 pages, with 204 Diagrams and Plates. 25s. net.

*Electrician.*—"Mr. Carter's book is welcome. The originality of his technical methods and his facility in mathematical analyses of engineering problems are well known, and both are fully exhibited here. There is no question but that the book is one that should be on the bookshelf of every railway electrical engineer, were it only for the locomotive and mechanics chapters."

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*The Times Engineering Supplement.*—"Can be fully recommended not only as a work of reference, but also as a treatise that will enable the reader to gain a mastery over the subject."

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By S. W. PERROTT, M.A.I., M. Inst. C.E., Professor of Civil Engineering in the University of Liverpool, and F. E. G. BADGER, A.M. Inst. C.E.

303 pages, many Diagrams. 30s. net.

*Railway Engineer.*—"The book with its figures, diagrams, and plates is a model in every way of what such a work should be."

## MODERN METHODS OF WATER PURIFICATION.

By JOHN DON, F.I.C., A.M.I. Mech. E., and JOHN CHISHOLM, A.M.I. Mech. E., Engineer and Manager of the Airdrie, Coatbridge and District Waterworks.

SECOND EDITION. xviii + 398 pages, 106 Illustrations. 16s. net.

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By H. PERCY BOULNOIS, M. Inst. C.E., Chairman of the Council of the Roads Improvement Association, etc. With Illustrations. 16s. net.

**London: EDWARD ARNOLD & CO., 41 and 43, Maddox St., W. 1.**



# OPPORTUNITY OFFERED.

Firm of Manufacturing Engineers, opening an office in Liverpool, and employing salaried travellers, are prepared to Represent a few other Manufacturers of repute, in Northern Counties, on a guaranteed commission basis, in following lines:—Shipyard Tools, Fittings, and Appliances, Boilers, Electric Motors, Steam Appliances and Packings, Steel and Iron, and any good specialities.

Those firms requiring real LIVE Representation on an economical basis should not miss this opportunity, as the Office will be under the control of one of the Directors of the firm, who has had 12 years' experience in Selling Organisation.

Address, in first instance, 431, The Engineer Office. 431


## SITUATIONS WANTED (continued)

ENGINEER, to Take Charge of Heavy Oil or Gas Engines. London district preferred. Varied experience in shops, outside erection and repairs. At present with leading makers.—Address, P6245, The Engineer Office. P6245 B

ENGINEER, with Considerable and Valuable Mechanical, electrical, and metallurgical experience, commercial and research, SEEKS CHANGE; practical, administrative or advisory position sought where scope exists. Not afraid of work, capable, and willing to render excellent service to right firm. Probably able to influence fair amount of business under suitable conditions.—Address, P6230, The Engineer Office. P6230 B

EX-OFFICER, Pilot, R.F.C., Age 24, B.Sc. (Civil Eng.), Eng. Coll. Certificate, qualified draughtsman and surveyor and practical knowledge. Would civil engineer interview with view to APPOINTMENT, asst., pupil or offers, please?—Address, 534, The Engineer Office. 534 B

EXPERIENCED COMMERCIAL ENGINEER DESIRES responsible POSITION with scope for energy and initiative. Age 38, A.M.I.M.E., marine and land experience, keen and successful salesman, specialist in boilers and steam plant; for 8 years before the war London manager to leading engineering firm. Highest references.—Address, P6252, The Engineer Office. P6252 B

LATE INDIAN GOVERNMENT OFFICIAL DISENGAGED owing to "Indianisation" scheme. Qualified mechanical engineer, open for engagement early in 1923. Age 34, A.M.I. Mech. E., Englishman, married, public school and workshop trained; 13 years' commercial and Government experience in England and India. Well connected and recommended. Willing to go abroad, preferably Colonies.—Reply to "BRITISHER," c/o King, King and Co., P.O Box 110, Bombay, India. P6197 B

PRACTICAL WORKS-TRAINED ENGINEER, 8 years present employers, assistant works manager, DESIRES CHANGE, Superintendent or Assistant Works Manager with large engineering concern at home or abroad; expert on production, cost, capable organiser, proved ability, tactful and initiative.—Address, P6223, The Engineer Office. P6223 B

DRAUGHTSMAN, 4 Years' Good General Experience, including petrol engines, motor cycles, jigs and tools, &c.; quick, neat and accurate; willing to go anywhere.—Address, P6225, The Engineer Office. P6225 B

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# German Capital Ship and Light Cruiser Building Programme, 1914 1918.

It has been correctly stated that at the end of the war the Germans were only building U boats, torpedo craft and small auxiliaries. When war broke out, however, they had quite a big programme on hand, including battleships, battle-cruisers and light cruisers. It will be remembered that the German Navy Bills principally dealt with the big ship, and most of the warships in progress in 1914 were replacements of older ships in accordance with those Bills.

It is of interest to note the policy as the war progressed in the light of the ships laid down. When the war broke out the German High Sea Fleet consisted of three battle squadrons, the third of which contained the most modern ships, namely, the Kaiser, Kaiserin, König Albert and Prinzregent Luitpold, each of which mounted ten 12in. guns, with fourteen 5.9in. guns as a secondary armament, on a displacement of 24,300 tons. Their maximum speed was 22 knots, and these ships did not compare in offensive powers with contemporary British battleships. The cruiser squadron included only three battle-cruisers, the Seydlitz and Moltke, each mounting ten 11in. guns, and the Von der Tann, with eight 11in. guns. There was another battle-cruiser, the Goeben, in the Mediterranean, but she was too far away to be of value in the North Sea.

It is now proposed to describe the ships in hand when the war broke out. The battleships are detailed in Table I.

From this statement it will be seen that two battleships, the König and the Grosser Kurfurst, were added to the High Seas Fleet in the first month of the war, whilst two more, the Markgraf and the Kronprinz Wilhelm, were added before the end of 1914. These four ships were contemporary with the "Emperor of India" class, each of which carried ten 13.5in. guns. In each of these German ships the oil stowage only totalled 700 tons, against a bunker capacity for 3500 tons of coal.

In addition to the above, the battleship Salamis was building at the Vulcan Yard, Hamburg, for the Greek Navy, but at the outbreak of war all progress on this ship was suspended. In fact, some of her guns, which were to come from America, were used on the British monitors.

It will be noted that the Bayern was completed in April, 1916, and really she set out to meet the German fleet after Jutland. Actually at that battle the most recent battleship on the German side was the Kronprinz Wilhelm.

Only two more battleships were commenced by the Germans, and they were part of the 1914–15 programme. They were named the Wurtemberg and Sachsen, and were similar to the Baden and the Bayern. The former was laid down at the Vulcan Yard, Hamburg, and the Sachsen was building by Krupps at their Germania Yard at Kiel. The designed power of these ships was 48,000 shaft horse-power, but actually the Baden obtained 55,000 shaft horse-power, and it was anticipated that that figure would be attained in these two later ships.

The Wurtemberg and Sachsen were both launched in 1917, and after the armour belt was fitted and some of the machinery shipped, the work was stopped so that the two shipyards could devote their energies to U-boat construction. The condition of the Sachsen can be judged from Fig. 1, which shows this ship as she was when peace was signed. The Sachsen was unique, in that her centre propeller was to be driven by a Diesel engine of 12,000 brake horse-power. Messrs. Krupps, of Kiel, designed and built the engine, but it was never installed on the ship.

These two battleships, together with other war-

Table I.

| Name. | Programme year. | Shipyard. | Keel laid. | Completed. | Displacement. | Horse-power. | Speed. | Armament. | Complement. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Tons. | | Knots. | | |
| König | 1911–12 | Wilhelmshaven Dockyard | Oct., 1911 | Aug., 1914 | 25,390 | — | 21–22 | 10–30.5 cm. (12in.), 14–15 cm. (5.9in.), 10–8.8 cm. H.A., 5 torpedo tubes | 1130 |
| Markgraf | 1911–12 | Weser A.G., Bremen | Nov., 1911 | Nov., 1914 | 25,390 | — | 21–22 | Ditto | 1130 |
| Grosser Kurfurst | 1911–12 | Vulcan, Hamburg | Oct., 1911 | Aug., 1914 | 25,390 | — | 21–22 | Ditto | 1130 |
| Kronprinz Wilhelm | 1912–13 | Krupps Germania, Kiel | May, 1912 | Dec., 1914 | 25,390 | — | 21–22 | Ditto | 1130 |
| Bayern | 1913–14 | Howaldts, Kiel | Sept., 1913 | April, 1916 | 28,070 | 55,000, 48,000 (desig'd) | 22¼ | 8–38 cm. (15in.), 16–15 cm. (6in.), 2 H.A., 3 torpedo tubes | 1163 |
| Baden | 1913–14 | Schichau, Dantzig | Feb., 1914 | Nov., 1916 | 28,070 | Ditto | 22¼ | Ditto | 1163 |

Table II.

| Battle-cruiser. | Programme year. | Shipyard. | Keel laid. | Completed. | Displacement. | S.H.P. | Speed. | Armament. | Crew. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Tons. | | Knots. | | |
| Derfflinger | 1911–12 | Blohm and Voss | M'ch, 1912 | Nov.,'1914 | 26,180 | 80,000 | 26¼ | 8–30.5 cm. (12in.), 12–15 cm. (5.9in.), 4–50 cm. tubes | 1120 |
| Lutzow | 1912–13 | Schichau, Dantzig | Aug., 1912 | Spring,'15 | 26,600 | 80,000 | 26¼ | Ditto | 1120 |
| Hindenburg | 1913–14 | Wilhelmshaven Dockyard | Nov., 1913 | Aug., 1915 | 27,900 | 80,000 | 26¼ | Ditto | 1120 |

Table III.

| Battle-cruiser. | Programme year. | Building yard. | Date of launch. | Displacement. | S.H.P. | Speed. | Armament. | Crew. |
|---|---|---|---|---|---|---|---|---|
| | | | | Tons. | | Knots. | | |
| Graf Spee | 1914–15 | Schichau, Dantzig | 1916 | 31,000 | 90,000 | 28 | 8–35 cm. (14in.), 12–15 cm. (5.9in.), 8–8.8 cm. H.A., 5 torpedo tubes | 1429 |
| Mackensen | 1914–15 | Blohm and Voss | 1916 | 31,000 | 90,000 | 28 | Ditto | 1429 |
| Ersatz Freya | 1915–16 | Blohm and Voss | Not launched | 33,000 | 110,000 | 29 | 6–38 cm. (15in.), 12–15 cm. (5.9in.), 5 torpedo tubes | Apprx. 1500 |
| Prinz Eitel Friedrich (Ersatz A) | 1915–16 | Wilhelmshaven | Not launched | 33,000 | 110,000 | 29 | Ditto | Apprx. 1500 |

Table IV.

| Name. | Ordered. | Displacement. | Horse-power. | | Weight in pounds per H.P. | |
|---|---|---|---|---|---|---|
| | | | Designed. | Attained or anticipated. | Designed. | Attained or expected. |
| | | Tons. | | | | |
| Battleship— | | | | | | |
| Ostfriesland | 1908 | 22,800 | 28,000 | 35,500 | 139 | 111 |
| Wurtemberg | 1914 | 28,700 | 48,000 | 55,000 | 93.5 | 81.5 |
| Battle-cruiser or armoured cruiser— | | | | | | |
| Blücher | 1906 | 15,500 | 36,200 | 44,000 | 131 | 108 |
| Ersatz Yorck | 1915 | 33,500 | 90,000 | 110,000 | 79.4 | 64.8 |
| Light cruisers— | | | | | | |
| Emden | 1907 | 3,500 | 15,000 | 16,350 | 119.0 | 109.0 |
| Köln | 1916 | 5,600 | 31,000 | 50,000 | 93.5 | 58.0 |

admitted that the subdivision of the German ships was more minute than in the British ships. The extent to which it was carried can be judged from the fact that the main machinery of the Baden was enclosed in fifteen different compartments—nine boiler-rooms and six main machinery spaces.

As regards time taken to build, it will be seen from the details given in Table I. that the average time for a battleship was about two and a-half years, which is not so good as for British ships of corresponding date.

As previously mentioned, the High Sea Fleet had only three battle-cruisers available when hostilities commenced, and, in addition, three more were building and well advanced. These are set out in detail in Table II. given above, by referring to which it will be seen that the battle-cruiser strength of the enemy was increased by the Derfflinger before the end of 1914, the Lutzow in the spring of 1915, and the Hindenburg in August, 1915, thus doubling its numbers in the first year of the war. All these ships had 12in. guns as their main armament, being the first German battle-cruisers so armed. It is of interest to note that whilst the Lutzow could only carry 1000 tons of oil, contemporary British ships of the same class carried about three times as much. That was due to the oil shortage in the country and was a distinct handicap.

The German Admiralty was impressed with the battle-cruiser type and had provided for two ships of that class in 1914–15 and in 1915–16 also. Particulars are given in Table III.

In addition, there was certainly one more battle-cruiser just started, the Ersatz Yorck, probably at Schichau, Dantzig, and possibly two more, included in the 1916–17 programme, but never started owing to the concentration on U-boat construction.

There were several interesting features in these large cruisers. The Graf Spee and Mackensen were to have 35 cm. (14in.) guns and would have been the first battle-cruisers to mount a gun larger than 30.5 cm. (12in.), whilst the Ersatz A and Ersatz Freya were

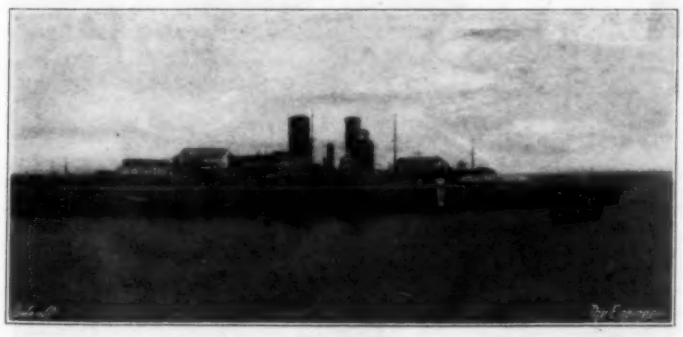


FIG. 1—THE BATTLESHIP SACHSEN

FIG. 2—THE LIGHT CRUISERS ROSTOCK AND WIESBADEN

ships building when peace was declared, have had to be broken up in compliance with the Versailles Treaty. The alternative of utilising the hulls for ordinary mercantile purposes was not a commercial proposition, and accordingly the structures were broken up and the metal sold as scrap.

The principal features of the German warships were described in papers read before the Institution of Naval Architects by Sir E. H. Tennyson D'Eyncourt and Mr. S. V. Goodall in 1921, and for details as to construction and also a comparison with contemporary British warships those contributions should be consulted. It is only proposed to touch on one or two of the salient points. In gun power, ship for ship, the German was invariably behind the British. Much has been said about subdivision, and it must be

designed to carry 38 cm. (15in.) guns, and so were in line with the British battle-cruisers built during the war. The horse-power and speed were also slightly increased. The Ersatz A had four propellers, each of which was independent. The 110,000 shaft horse-power was evenly distributed between the four shafts. As originally designed, a Föttinger hydraulic transmission—turbo-transformer—was to be used. The turbines themselves were to run at 1360 revolutions per minute, and there was a reduction of 4.3 to 1 by means of the transformer, so that the propellers made 315 revolutions per minute at full speed. It is claimed that the efficiency would have been very good. Actually, however, German engineers have for some time favoured mechanical reduction gear, and it is being fitted to all classes of ships at present. The Graf Spee and Mackensen were to be fitted with mechanical reduction gear and the shaft horse-power of 90,000 was to be divided over four quite independent shafts.

In these battle-cruisers the main machinery compartments were relatively small, owing to the excessive subdivision. The condenser and auxiliary machinery would be in a separate compartment from the main turbines for each shaft, and thus there would be eight engine-rooms.

In light cruisers the High Sea Fleet was weak, judged from the standard set up as the war progressed. There were only six of the "Town" class in the cruiser squadron, viz., the Köln, Mainz, Stralsund, Kolberg, Rostock, and Strassburg. Each of these ships displaced 4500 tons, carried twelve 10.5 cm. (4.1in.) guns, and had two revolving torpedo tubes on the upper deck. They could steam at 27 to 28 knots. There were also five others of approximately the same dimensions on the trade routes or attached to Admiral Von Spee's squadron, whilst the Breslau was attached to the Goeben in the Mediterranean.

The light cruisers built during the war and in hand when the war ended are shown in Table V. given above. The losses in this class of vessel in actual service were considerable, and the new cruisers were generally first named Ersatz, or replace. It will be seen in the table that two of the cruisers building at Weser A.G.

TABLE V.—*Light Cruisers, Built and Building*, 1914–1918.

| Name. | Programme year. | Building yard. | Launched. | Displacement. | Speed. | Armament. Guns. | Armament. Tubes. | Complement. | Disposal.* |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Tons. | Knots. | | | | |
| Graudenz | 1912–13 | Kiel Dockyard | Oct., 1913 | 4900 | 29 | 12–10.5 cm. (4.1in.), 2 M.G. | 2 | 385 | Italian Navy as Ancona |
| Regensberg | 1912–13 | Weser A.G. | April, 1914 | 4900 | 29 | 12–10.5 cm. (4.1in.), 2 M.G. | 2 | 385 | French Navy as Strassburg |
| Pillau (Russian Murawgew Amurski) | — | Schichau, Dantzig | 1914 | 4400 | 27.5 | 8–15 cm. (5.9in.), 4–5.2 cm. (2in.) | 2 | 437 | Italian Navy as Bari |
| Elbing (Russian Admiral Neweski) | — | Schichau, Dantzig | 1914 | 4400 | 27.5 | 8–15 cm. (5.9in.), 4–5.2 cm. (2in.) | 2 | 437 | Sunk at Jutland |
| Konigsberg (Ersatz Gazelle) | 1914–15 | Weser A.G. | 1915 | 5300 | 27.5 | 8–15 cm. (5.9in.), 2–8.8 cm. (3.5in.) H.A. | 4 | 475 | French Navy as Metz |
| Wiesbaden (Ersatz Gefion) | 1913–14 | Vulcan, Stettin | 1915 | 5150 | 27.5 | 8–15 cm. (5.9in.), 4–5.2 cm. (2in.) H.A. | 4 | 480 | Sunk at Scapa Flow |
| Frankfurt (Ersatz Hela) | 1913–14 | Kiel Dockyard | 1915 | 5150 | 27.5 | 8–15 cm. (5.9in.), 4–5.2 cm. (2in.) H.A. | 4 | 480 | Sunk at Jutland |
| Karlsruhe (Ersatz Niobe) | 1914–15 | Kiel Dockyard | 1916 | 5300 | 27.5 | 8–15 cm. (5.9in.), 2–8.8 cm. (3.5in.) H.A. | 4 | 475 | Sunk at Scapa Flow |
| Emden (Ersatz Nymphe) | — | Weser A.G. | 1916 | 5300 | 27.5 | 8–15 cm. (5.9in.), 2–8.8 cm. (3.5in.) H.A. | 4 | 475 | Sunk at Scapa Flow |
| Nurnberg (Ersatz Thetis) | — | Howaldts, Kiel | 1916 | 5300 | 27.5 | 8–15 cm. (5.9in.), 2–8.8 cm. (3.5in.) H.A. | 4 | 475 | Sunk at Scapa Flow |
| Köln (Ersatz Ariadne) | — | Weser A.G. | 1916 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | Sunk at Scapa Flow |
| Dresden (Ersatz Dresden) | — | Weser A.G. | 1917 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | Sunk at Scapa Flow |
| Wiesbaden (Ersatz Nurnberg) | — | Vulcan, Stettin | 1917 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | |
| Rostock (Ersatz Mainz) | — | Vulcan, Stettin | 1918 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | |
| Magdeburg (Ersatz Magdeburg) | — | Howaldts, Kiel | 1917 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | Broken up in accordance with Peace Treaty |
| Frauenlob (Ersatz Konigsberg) | — | Kiel Dockyard | 1918 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | |
| Leipzig (Ersatz Leipzig) | — | Weser A.G. | 1918 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | |
| (Ersatz Emden) | — | Weser A.G. | 1919 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | Launched to clear slips and then broken up |
| (Ersatz Köln) | — | Weser A.G. | 1919 | 5600 | 27.5 | 8–15 cm. (5.9in.), 3–8.8 cm. (3.5in.) H.A. | 4-60 cm. (23.6in.) revolving | 526 | |

TABLE VI.
Date of launch given for vessels completed or launched in brackets.

| Shipyard. | Ships completed, August, 1914—November, 1918. Battleships. | Battle-cruisers. | Light cruisers. | Ships in hand, November, 1918. Battleships. | Battle-cruisers. | Light cruisers. | Remarks. |
|---|---|---|---|---|---|---|---|
| Wilhelmshaven Dockyard | Konig (1913) | Hindenburg (1915) | — | — | Ersatz A. | — | |
| Kiel Dockyard | — | — | Graudenz (1913) Frankfurt (1915) Karlsruhe (1916) | — | — | Frauenlob (1918) | |
| Krupps Germania, Kiel | Kronprinz Wilhelm (1914) | — | — | Sachsen (1917) | — | — | |
| Howaldts, Kiel | Bayern (1915) | — | Nurnberg (1916) | — | — | Magdeburg (1917) | |
| Vulcan, Stettin | — | — | Wiesbaden (1915) Bremse (1917) | — | — | Wiesbaden (1917) Rostock (1918) | |
| Vulcan, Hamburg | Grosser Kurfurst (1913) | — | — | Salamis* Wurtemberg (1917) | — | — | *Building for Greek Government and stopped |
| Blohm and Voss, Hamburg | — | Derfflinger (1913) | Brummer (1917) | — | Mackensen (1916) Ersatz Freya | — | |
| Schichau, Dantzig | Baden (1915) | Lutzow (1913) | Pillau (1914)†† Elbing (1914)† | — | Graf Spee (1916) | — | †Originally ordered by Russian Admiralty |
| Weser A.G., Bremen | Markgraf (1913) | — | Regensberg (1914) Konigsberg (1915) Emden (1916) Köln (1916) Dresden (1917) | — | — | Leipzig (1918) Ersatz Köln (1919) Ersatz Emden (1919) | |

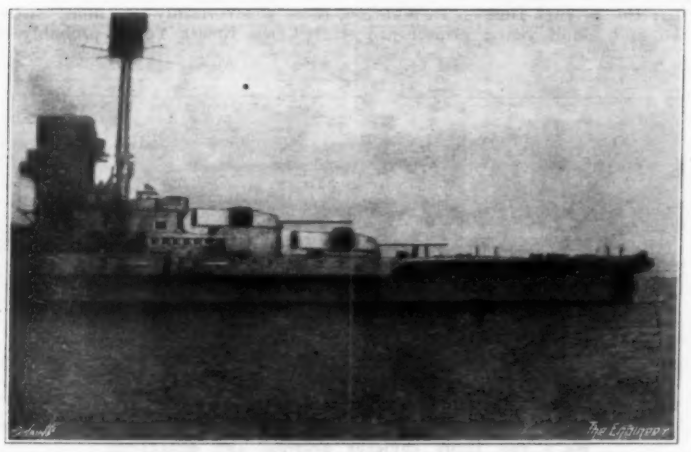


FIG. 3—THE GROSSER KURFURST AFTER RAMMING THE KRONPRINZ

FIG. 4—SHELL HIT ON DECK OF SEYDLITZ

when the war ended were the Ersatz Emden and the Ersatz Köln. The light cruisers in hand at the Armistice were all of one class, and the following particulars of this class may be of interest. The length was 489ft., the beam 47ft., and the displacement 5600 tons at 16ft. 6in. draught. The fuel carried was 1118 tons of coal with 682 tons of oil. There were fourteen boilers in five boiler-rooms, of which eight burnt coal and oil and six burnt oil only. The shaft horse-power of 29,000 gave a speed of 27.5 knots. The armament consisted of eight 15 cm. (5.9in.) and

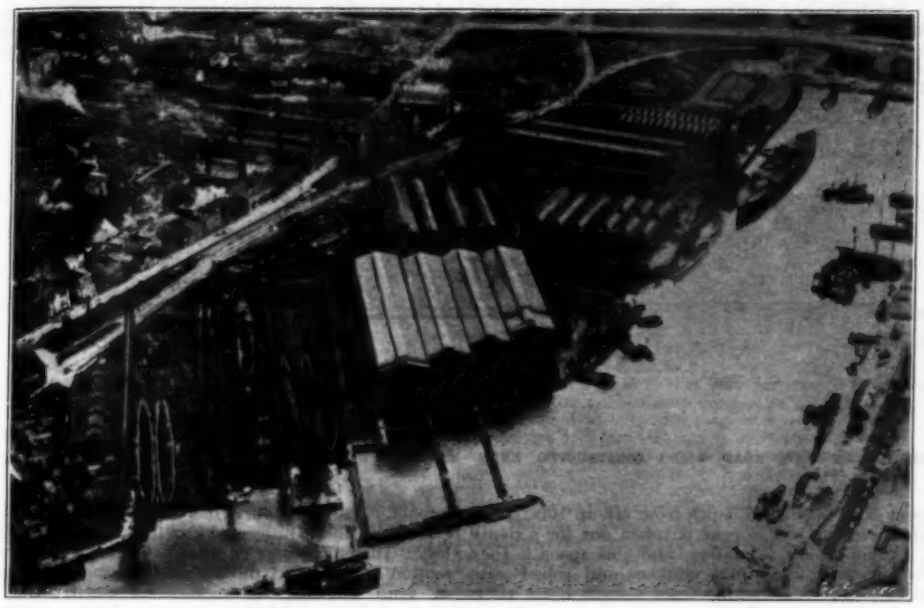


FIG. 5—BIRD'S-EYE VIEW OF KRUPP'S GERMANIA YARD AT KIEL

three 8.8 cm. (2.5in.) high-angle guns and four single 60 cm. (23.6in.) revolving deck torpedo tubes. The side protection was about $2^5/_{16}$in. thick and protective deck about $\frac{3}{4}$in. thick. The complement was 526. An idea of the general arrangement of this class of vessel can be obtained from Fig. 2, which shows the Wiesbaden and Rostóck lying alongside the wharf at the Vulcan Works, Stettin. These cruisers were launched in 1917 and 1918 respectively and work upon them was pushed on until the Armistice.

In addition, two special light cruisers were built for minelaying, named the Brummer and the Bremse,

FIG. 6—SHELL HITS ON TURRET OF SEYDLITZ

by Blohm and Voss and Vulcan, Stettin, respectively. These ships were designed for high speed, and some machinery on order by the Russian Admiralty, which was in hand in Germany when war broke out, was utilised to save time. The Bremse was built in twelve months. Each vessel could carry 300 mines and the armament included four 15 cm. (5.9in.) and two 8.8 cm. (3.5in.) high-angle guns and two deck torpedo tubes. The speed obtained was 30 knots, and these cruisers were intended for minelaying at a distance, their offensive powers being sufficient to enable them to make a fight against an isolated cruiser if necessary.

Of the light cruisers left in Germany after the Armistice a number were surrendered to the Allies and incorporated in the Italian and French Navies and re-named as indicated in Table V. These ships were mainly the cruisers completed after the Battle of Jutland. Those not complete had to be broken up in accordance with the Peace Treaty.

It is interesting to note that three light cruisers were launched in 1914 and in 1915, four in 1916, three in 1917 and 1918, and two in 1919, to clear the slipways at Weser A.G. shipyard. Before closing this section we would draw attention to the short summary given in Table IV., which shows the progress in size and horse-power of the various classes of ships.

The distribution of this warship building work over the various shipyards is of interest. The submarines were built in nearly every shipyard, with the exception of Vulcan Yard at Stettin and the Schichau Yard at Dantzig, which were employed on torpedo boat construction.

Table VI., on page 374, shows the distribution of the battleship, battle-cruiser and light cruiser building in the various yards. It will be noticed that Blohm and Voss specialised in battle-cruisers; Vulcan, Hamburg, and Krupps Germania Yard, at Kiel, built battleships; whilst Schichau, Dantzig, and Wilhelmshaven built both battleships and battle-cruisers; Weser A.G., at Bremen, built the largest number of light cruisers; and Kiel Dockyard built only that type of ship.

An aeroplane photograph of Krupps Germania Yard at Kiel, taken immediately after the Armistice, is reproduced in Fig. 5. The Sachsen can be quite distinctly seen alongside the fitting-out berth. A number of submarines can also be seen and the general arrangement of the yard is clearly indicated. The equipment of the German shipyards as a whole was well adapted for warship construction. The lifting appliances were very extensive and the shop equipment included the latest and heaviest machinery. In addition to building these warships, the principal yards had also to effect repairs, and in one case the salvage of a battleship, the Rheinland. The latter ran ashore on an island in the Baltic during the expedition against Riga. She was so fast and so badly damaged that she could not be got off until lightened by nearly 6000 tons. Of this weight over 4000 tons was removed by taking out guns, coal, stores, armour on turrets and sides, and then, to get the required buoyancy, a series of camels was arranged on either side of the hull, giving a total lift of 3000 tons. After months of work in bad weather the ship was towed to Kiel, but never repaired, as the damage was so extensive.

The Dogger Bank Battle and the Jutland Battle also gave much work. After the former the Derfflinger went into the Vulcan Yard, Hamburg, badly damaged, and the Seydlitz was repaired at Wilhelmshaven. In March of 1917 the Grosser Kurfurst rammed the Kronprinz and was badly damaged, the bow being crumpled up. A photograph showing the damage is reproduced in Fig. 3. After Jutland the damaged ships were repaired as speedily as possible. The most seriously damaged was the battle-cruiser Seydlitz, and she only reached Wilhelmshaven with great difficulty and was docked in one of the entrance locks there, with the Derfflinger in the other lock alongside it. Two photographs, showing the damage caused to one of the turrets and also to the deck of the Seydlitz, are given in Figs. 4 and 6. The Moltke was also torpedoed and she was docked and repaired in Wilhelmshaven Yard. In addition to these large repairs there was always refitting work for the big ships and also repair and maintenance work on the numerous torpedo craft and light cruisers.

The U boat programme made the biggest demands on the German shipyards, and next to it came the torpedo craft; but, as will be seen above, the capital ship and light cruiser programme was quite considerable.

Adding these three programmes together one can get a good idea of the capacity of the shipbuilding industry in Germany working at full pressure. All this capacity is now available for mercantile work, as the post-war building allowed for the navy by the Peace Treaty is very small indeed, and Germany may not build warships for foreign Powers.

## Concrete Roads in Manchester.

By J. B. L. MEEK, M. Inst. C.E.

Two years ago, in the latter part of 1920, it became necessary to find work for the unemployed in the Manchester district, and in considering the most suitable kind of work to meet the emergency, the Corporation favoured the construction of some arterial roads that had been already decided upon under town-planning schemes, as being work which could be put in hand at once; and which would provide employment for the largest amount of unskilled labour. The majority of the roads on which it was decided to commence work were either 100ft. in width between fences or 80ft. in width between fences. The town-planning scheme provided that the 100ft. road should consist of two carriageways, each 20ft. in width, a centre space of 28ft. to be reserved for a double line of tramway fenced off from the two carriageways, but with suitable crossing places for vehicular traffic arranged at frequent intervals, and two 16ft. footpaths.

The 80ft. road was to consist of a 50ft. carriageway and two 15ft. footpaths, as it was considered unlikely that any tram service would be required on these roads. The actual form of construction of these carriage-ways and footpaths was not finally decided under the town-planning scheme, as it was considered unlikely that any of these roads would be constructed in the then immediate future, and, in view of the many improvements constantly taking place in road construction, it appeared unwise to draw up a hard-and-fast specification for work that would in all probability not be carried out for many years to come. The width of the footpaths was not altogether influenced by the requirements of pedestrian traffic, but also by the desire to make them wide enough to take all the usual underground services, and so avoid the frequent taking up of the carriageways consequent upon services being laid under them. The carriage-ways were designed to take lines of traffic in multiples of 10ft., it being thought, from observations of present-day traffic and with reasonable allowance for future traffic, that 10ft. would be an ample width for a travelling vehicle to occupy.

When it was decided to commence the construction of several of these roads at once to find work for the unemployed, the question of the actual make-up of the roads was influenced by the necessity of spending as much money as possible on labour and as little as possible on material. It was therefore decided in the case of the 100ft. road to complete all excavation and filling to formation level for the full width of the road, but only to pave one carriage-way and one footpath, so that the public might use the roads when completed, leaving the other carriage-way and footpath ashed and rolled until such time as the traffic justified a permanent paving or such was rendered necessary by development taking place in the vicinity of the roads. The centre portion of the road was simply left at formation level. Fig. 1 shows a cross section of the roads as they are being constructed at the present time. On only one of these roads were both carriage-ways paved. This road passes through a large housing estate. In the case of the 80ft. roads, the whole of the 50ft. carriageway is paved, as also are both footpaths. If only a portion of this road had been paved, it would have been an awkward matter to separate the paved portion from the unpaved portion, as no natural division existed like the tramway track on the 100ft. road.

Some little time previous to the commencement of these roads, the Corporation had laid down a concrete road in another part of the city in six experimental lengths, and the behaviour of this road for the short time it had been under observation seemed to indicate that a concrete surface would be successful in the case of these new roads, and it was accordingly adopted, but as a precaution the levels were so arranged that should the concrete surface prove unable to withstand the traffic, another wearing surface could be superimposed on it.

Speaking generally, these roads are not reinforced concrete roads, as reinforcement has only been used in the case of bad foundations or on embankments or where trenches had recently been opened across the roads to provide connections for the services from one footpath to the other. All departments controlling underground services, such as water, gas, electricity and telegraphs, were asked to put in any

crossings they might require under the carriage-way before it was concreted and reinforcement was used over these recently filled-in trenches.

The method of constructing the concrete carriage-way in all the roads was identical, despite the variation in width, and therefore a general description will suffice. Where there was a sound foundation, capable of supporting from 30 cwt. to 2 tons per square foot, which was generally the case, the method of constructing the carriage-way was as follows:—Three inches of ashes or clinkers were rolled and consolidated on the natural foundation to form a bed for the concrete. On this bed, after well watering, the concrete was directly placed. The total thickness of the concrete was 7in. laid in two courses, the bottom course being 5in. in thickness and the upper course 2in. in thickness. The proportions of concrete for the bottom course were approximately five parts of stone, two and a-half parts of sand, and one part of Portland cement, while for the top course they were two parts of stone, one of sand and one of Portland cement. It will be noticed that these proportions are stated to be approximate, as the voids in the stone were measured frequently during the course of the work and the proportions adjusted accordingly to obtain as dense a mixture as possible. The variations from the proportions mentioned proved, however, to be very slight. The stone in the bottom course was a good hard stone, obtained from districts as near to Manchester as such stone could be found, and was from 1½in. to ¼in. in gauge. The sand for this course, which was also obtained locally, was clean and free from organic matter, but was not very sharp. The stone for the upper course consisted of approved granite, ¾in. to ¼in. in gauge, while the sand was thoroughly good, sharp sand or granite grit. The Portland cement throughout had to comply with the British standard specification. By adopting this two-course method of construction, a long railway haul was avoided for the majority of the material, and a thoroughly sound granite wearing surface was provided. All the concrete was hand mixed and deposited in alternate bays of about 14ft. in length. When concreting started on a length of road, one gang proceeded to lay alternate bays, and in about ten days or a fortnight another gang followed along filling in the bays that the first gang had omitted.

In laying the concrete, the top and bottom courses were placed in position practically simultaneously in order that the whole thickness of concrete might set together in one homogeneous mass, and when once concreting had been commenced on a bay, no cessation of work was allowed until the bay had been completed. The upper surface of the concrete was finished off to the required levels and falls with a wooden or steel-shod template. No trowelling was done. The cross fall adopted was 1 in 60.

Where cross trenches had been recently excavated in the carriage-way foundation, single-mesh reinforcement was used, care being taken that the reinforcement had a good hold on each side of the trench in the concrete resting on the solid ground. This type of reinforcement was purchased from various makers who manufacture this class of material.

The roads were constructed with the approval of the Ministry of Transport, and with the assistance of grants-in-aid, either from that Ministry or from the Unemployment Grants Committee, and a date for completion was stipulated for some of the roads, while it was recognised for all of them that it would be advisable to complete them as soon as possible. This meant that in the case of embankments, little time would be available for them to settle before they had to receive a road surface. In the case of high embankments and bridge approaches, it was recognised that no form of concrete surface would be suitable, and accordingly a tar-macadam surface will be laid down until such time as these banks have become thoroughly consolidated. In the case of the smaller embankments, however, it was felt that some effort should be made to avoid breaking up the continuity of the road surface, and accordingly a reinforced concrete road was laid at these places.

The banks were first consolidated by watering and rolling, and the reinforced concrete structure placed on the well-rolled foundation of ashes. As these particular sections of road would be called upon to distribute the weights of the traffic exactly as any other form of foundation raft would be, it was recognised that they must be reinforced in a similar manner, and provision be made for tension in the top and bottom surfaces, and also for shear. For this purpose the Walker-Weston Company's reinforcement, which makes provision for these stresses, was used. The depth of these reinforced portions is 9in., and the carriage-way is extended for 1ft. 6in. under the kerb at each side of the road to give support to traffic travelling close to the kerb. The reinforced sections are constructed in bays as are the ordinary sections. An inch of concrete is first laid, and on this the reinforcement, 6in. in depth, is at once placed, and the concrete well worked round it with 2in. of concrete between the upper surface of the reinforcement and the finished road surface. This concrete consists entirely of granite and sand of good quality, the proportions and sizes of stone being the same as on the other portions of the roads.

One length of 80ft. road passes for a mile through a peat bog, varying in depth from 5ft. to 10ft. below formation level. The peat is taken out for a depth of 1ft. 6in. below formation, and this space is then filled in with ashes and clinkers and rolled with rollers of varying weights from a light horse roller to a heavy steam roller, more ashes being added as sinkage takes place. In some places the ashes alone cannot be made to support the weight of the rollers, and in these cases wattle hurdles are placed on the peat below the ashes. When the ashes have been so consolidated that they will bear a weight approaching 2 tons to the square foot without undue depression occurring under the wheels of the rollers, reinforced concrete slabs are constructed on the ash surface. Each slab is continued for a width of 2ft. 6in. beyond the kerb, and is thus 55ft. in width by 14ft. in length. The method of construction by alternate bays is similar to that adopted throughout the roads, but the thickness has been increased to 12in. at the centre and 9in. at the edge of the road, the reinforcement being 9in. in depth at the centre and 6in. at the outsides.

The surface of all concrete roads is kept damp for at least a week after the concrete has been placed, and in hot weather the surface is protected from the sun by wooden shades or pent houses on wheels that can be easily moved from bay to bay. In frosty weather the concrete is also protected from the effects of frost while setting. The kerbs and fence posts are manufactured in depôts adjacent to the work, the fence posts being reinforced by four ¼in. diameter steel bars. The paving flags for the footpaths are manufactured on the finished road surfaces and when matured are set on the footpaths. The kerbs, fence posts and flags are of 4½ to 1 concrete. In order to test the density of the concrete, pieces were cut out for the full 7in. thickness of the road, and after being a fortnight in a dry room and then immersed for eighteen hours in water, the absorption was found to be approximately 3 per cent.

The lengths of the various roads put in hand up to date totals just over 8 miles, and all the work, with the exception of steelwork for bridges, has been carried out by direct labour. At the busiest times nearly 2000 men have been employed and 400 tons of material handled per day at the various stations and depôts adjacent to the works. During the course of the work four bridges have been constructed to carry the various roads over railways. All these bridges are 100ft. wide between parapets, and three of them wide enough between abutments to span four lines of rail, one of them only being constructed to span two lines of rail. These bridges have been designed to carry a weight of 30 tons on a 6ft. by 8ft. 6in. trolley, with an allowance of 50 per cent. for impact. The steelwork has been constructed and erected by John Butler and Co., Limited, of Stanningley. The engravings on page 386 show a reinforced section of the road during construction; a length of road showing the method of construction in alternate bays; and two views of a bridge taking a road over the Midland Railway

This bridge, which is slightly on the skew, has a square span of 56ft. The girders are spaced at 6ft. 6in. centres, and are connected by 9in. brick jack arches springing from the lower flanges. The road surface is formed on concrete filling, which is taken up to just above the tops of the girders.

Some lengths of these roads have been opened to traffic for over a year, and other concrete roads in Manchester have been under traffic for two years, and as far as can be seen from this short trial, the surfaces show little signs of wear. For all rubber-tired traffic they appear to be eminently suitable, but whether steel tires or the constant hammering of iron hoofs will, in course of time, cause wear, seems to be doubtful. This, however, can be guarded against if a cheap and suitable thin covering can be obtained for this class of road. Ordinary tar-spraying has been tried, but has not been a success in Manchester. One or two special preparations have also been tried, and although superior to ordinary tar-spraying, they have not been quite the success that was anticipated.

Although concrete roads may be very suitable and economical in some positions, it would be manifestly impossible to construct them in other positions, such as, for example, in the centre of a large town, where, owing to the length of time that must elapse before the traffic can be allowed on them, altogether impossible delay and inconvenience would be caused to the public.

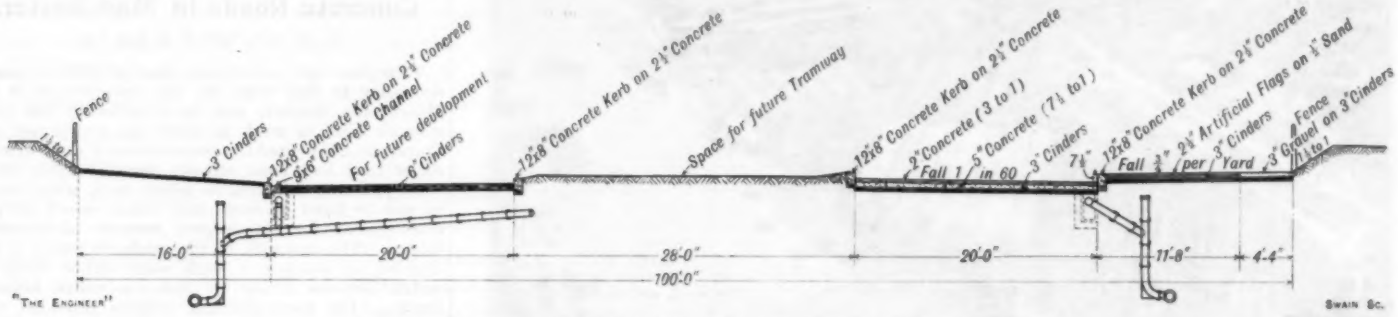



FIG. 1—CROSS SECTION OF NEW ROAD BEING CONSTRUCTED NEAR MANCHESTER

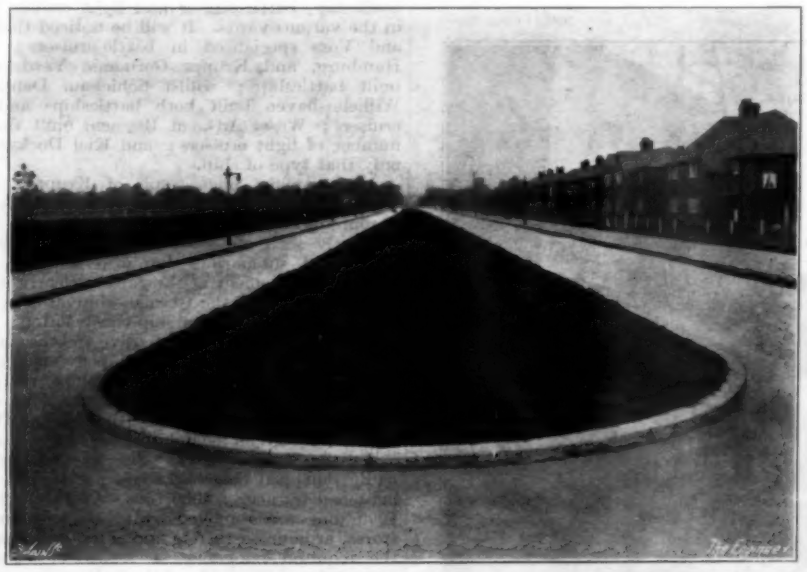


FIG. 2—VIEW OF CONCRETE ROAD WITH BOTH CARRIAGE-WAYS CONSTRUCTED

# Working Hours.

No. II.*

We give to-day some further extracts from the report of the Joint Investigation Committee on Working Hours.

Section II.—Summary of Information Furnished in Written Form by Representative Engineering Firms at the Request of the Committee.

*The information relates to the years* 1913 *and* 1919.

*Foreign Trade.*—In 1913 rather more than one-third of the product of the engineering industry was exported. It should be noted that approximately a third of the remainder depends on this export trade, and consequently the industry depends on export trade for one-half of its output. During 1919 the proportion of foreign trade in most branches of the industry was considerably lower than in 1913 for a variety of reasons, mainly arising out of the war. The urgent need for industrial reconstruction at home led to an immense demand for engineering products, while, so far as foreign orders were concerned, though there was an immense potential demand, it only became partially effective during 1919.

*Horse-power Available.*—In the case of all the firms which gave sufficient information to enable a comparison to be made, the position in the comparative years was as follows :—

| | 1913. | 1919. |
|---|---|---|
| Total horse-power of motors installed | 121,501 | 162,461 |
| Total number of employees | 114,841 | 131,172 |
| Horse-power per manual worker | 1.05 | 1.23 |

It will be noted that the increase in the power supplied per worker was just over 17 per cent.

*Numbers Employed.*—The numbers employed by the firms furnishing returns are shown in the following table :—

| | 1913. | 1919. |
|---|---|---|
| Males over twenty-one | 120,306 | 131,062 |
| Females over twenty-one | 2,080 | 7,309 |
| Males under twenty-one | 28,368 | 32,019 |
| Females under twenty-one | 1,484 | 2,756 |
| Total (males) | 148,674 | 163,081 |
| Total (females) | 3,564 | 10,065 |
| Grand total | 152,238 | 173,146 |

*Hours of Labour.*—In 1913 the 53-hour week, with the two-break system, predominated. In 1919 the 47-hour week, with the one-break system, was practically universal.

The following table shows the average number of hours worked per week per employee in each year :—

| | 1913. | 1919. |
|---|---|---|
| Timeworkers only | 49.6 | 44.8 |
| Pieceworkers only | 48.9 | 44.3 |
| All workers | 49.5 | 44.7 |
| Average overtime | 4.5 | 1.9 |
| Total average time worked | 54.0 | 46.6 |

*Payment by Results.*—Some system or other of payment by results is in operation to varying extents in practically all firms. Firms mention a number of cases where piecework would have been introduced but for objections raised by the trade unions concerned, and this applies particularly to patternmakers and foundrymen.

Between 1913 and 1919 there have been a certain number of cases of changes from timework to piecework. As a rule the change has been made on the initiative of the employers, but in some of the cases the application came from the workpeople. The result has been an increase in earnings and output.

It is reported that in a number of cases the efforts of the pieceworkers have been hampered through the fact that their assistants are not being paid by results, and in every case where it has been found possible to introduce payment by results for the assistants the result has been satisfactory. In most cases where it has been tested it has been found that a system of individual payment by results is better than a system of collective payment by results.

*Attitude of Men to New Appliances.*—Most firms report that they have received reasonable assistance from their employees in making the fullest use of up-to-date appliances and new methods of work, but objections to the introduction of new appliances are reported in a certain number of cases. The most general objection that is reported is to the employment of moulding machines in the foundry.

Some firms state that they find difficulty in inducing men to superintend more than one machine, even though there is no difficulty at all in doing so.

*Foundry Equipment.*—With regard to foundry equipment, there was a considerable increase in the number of firms using moulding machines in 1919 as compared with 1913. The increase applies both to hand-operated moulding machines and power-operated.

In general, moulding machines were not operated by fully skilled men, and the increase in 1919 compared with 1913 was mainly amongst men not fully skilled.

Section III.—Visits to Works in June and July, 1920.—List of Firms Visited.†

Sir W. G. Armstrong, Whitworth and Co., Limited, Close Works, Newcastle; Sir Wm. Arrol and Co., Limited, Glasgow; Babcock and Wilcox, Limited, Renfrew; Wm. Beardmore and Co., Limited, Dalmuir; John Brown and Co., Limited, Clydebank; Cammell Laird and Co., Limited, Birkenhead; Clarke, Chapman and Co., Limited, Gateshead-on-Tyne; Cole, Marchent and Morley, Limited, Bradford; Darlington Forge Company, Limited, Darlington; Dennis Bros., Guildford; T. W. Dickson, Whitechapel; Fairbairn Lawson Combe Barbour, Limited, Leeds (Lawson Branch); Fairbairn MacPherson Branch, Leeds; John Fowler and Co., Limited, Leeds; R. and W. Hawthorn, Leslie and Co., Limited, Newcastle-on-Tyne; R. and W. Hawthorn, Leslie and Co., Limited, Hebburn-on-Tyne; Lithgows, Limited, Port-Glasgow; North British Locomotive Works, Hyde Park, Glasgow; J. Stone and Co., Limited, Deptford; Swan, Hunter and Wigham Richardson, Limited, Wallsend-on-Tyne; Vickers Limited, Barrow-in-Furness; Wallsend Slipway and Engineering Company, Limited, Wallsend-on-Tyne; J. Warner, Limited, Whitechapel.

Equipment and Organisation.

*Case* 1.—The works were established fifty years ago, but some of the older shops—and this applies in particular to the foundries—are out of date in equipment, partly because moulders object to moulding machines.

*Case* 2.—As a whole the shops are satisfactory and well equipped. One shop is covered in at one end and not the other. The timekeeping at the covered-in end is much more satisfactory than at the other end.

*Case* 3.—The speed of operation of the machines was high.

*Case* 4.—The shipyard has a large number of building berths, some of which are covered in. Timekeeping in the covered berths is not satisfactory.

*Case* 5.—The building berths are splendidly equipped, together with all the shops that are necessary to make all fittings. Two of the berths are covered in, but despite this half the workers employed in these covered-in berths stayed away when it was wet. The plating shops are covered in, and wet weather has no ill effect on timekeeping in these.

*Case* 6.—The largest machine shops are old, and the driving arrangements of the machine tools are not up to date. Though many of the machines are not of the latest type, yet many of them have been designed and constructed by the firm for carrying out specific operations, and great thought has been devoted to the design of both the machines and the jigs used, and the organisation of production appeared to be good. The equipment of other machine shops is more modern than that of the large machine shops. The foundry is old and the ventilation not very good, but the crane equipment is efficient, and pneumatic and hydraulic machines had been installed, but had been abandoned in favour of hand-operated machines, as being more satisfactory. Pneumatic appliances had been abandoned in the fettling shop on account of the very high cost of maintenance.

*Case* 7.—Though the nature of the firm's output prevents mass production, strictly so called, there is a great number of parts produced on repetition lines, and the Committee was of the opinion that considerable improvements might be effected in the present method of machining such parts and by working on more standardised lines.

Timekeeping and Overtime.

*Case* 2.—The management stated that, in addition to the improved timekeeping, which resulted from the shorter working week and better arrangements for the supply of material, coupled with more efficient management and the closest supervision of the progress of material through the shops, many of the difficulties with regard to the rate of output were obviated.

*Case* 4.—The shipyard was out of balance, partly due to shortage of production from the shipwrights' department, due in turn to the shortage of men and the non-adoption of a system of payment by results which would compensate for the unavoidable shortage of men. If this balance could be restored, a further thousand workers could have been employed.

*Case* 18.—It was observed that the men ceased work some considerable time before the proper stopping time.

*Case* 8.—Timekeeping is fairly good. Two or three minutes' grace is allowed, but men arriving after the period of grace has expired are shut out until the dinner hour, unless good cause can be shown for being late. When men are shut out in the morning, they seldom return until the next day. Each case is investigated by the foreman at the time. It was complained that much time is lost every day due to the men ceasing work before the regular stopping time, and that it is a common thing to find some 50 per cent. of the men had ceased work about fifteen minutes before the proper stopping time in the afternoon.

*Case* 9.—Complaint was made by the management of the bad timekeeping of certain sections of workers, especially the riveters, the average weekly hours worked in the month of March being only thirty-eight. It was stated in answer to a question as to timekeeping, that it was no better than the year before.

*Case* 10.—The firm had no serious complaint to make in regard to timekeeping of the men, except in the boiler shop. It was stated the firm had always enjoyed a reputation for good timekeeping.

*Case* 6.—No complaints were made about timekeeping. It was stated that all reasonable latitude is given to the workpeople who start work after the regular time of starting if the lateness was due to unforeseen circumstances in connection with transport facilities, &c.

*Case* 11.—The firm had no complaint whatever to make as to timekeeping on the part of their workmen.

*Case* 12.—Owing to the restriction on overtime, shops have become seriously out of balance from time to time and considerable loss of output had been caused. The firm had done all they could to overcome this by getting additional men, adjusting prices, and working a night shift, and the output of boilers had increased from sixteen to thirty-eight per month. Unfortunately, the moulders' strike shortly afterwards unbalanced various sections of the works and output in the boiler shop had to be reduced.

*Case* 13.—Timekeeping seems to be very unsatisfactory, and it was ascertained from the firm's daily records that out of 6600 employed in the shipyard there were on an average 500 absentees per day. The Committee, when going through the yard, noticed from 11.35 a.m. till noon, when the works stopped for the dinner hour, considerable numbers of men had ceased work and were proceeding to the main exits, large numbers being gathered at the time office when the buzzer blew.

*Case* 14.—Timekeeping was unsatisfactory. Out of 5000 employees in the shipyard there were on the average 236 absent every day. Timekeeping in the engineering departments is bad, but not as bad as in the shipyard. There were many complaints as to the slackness of the men in both starting and stopping work, and the Committee saw for themselves plentiful evidence of this disgraceful state of affairs in the portion of the works they happened to be in just before twelve noon.

*Case* 15.—In the dry dock department it was stated that there is no general complaint to make except after holidays.

Systems of Payment.

*Case* 16.—The semi-skilled operators who operate moulding machines in the foundry are on piecework, and the whole of the electrical departments are on piecework.

*Case* 17.—All work is done on payment by results, the "Halsey" system being used mainly.

*Case* 1.—At the time of the visit 30 to 40 per cent. of the men were working on time, but generally work is done on piece. In the forge a tonnage basis prevails.

*Case* 2.—During the war all work was on piece. After the Armistice timework was resumed, with the result that output was considerably reduced. The situation became so bad that the firm seriously considered closing down the whole of the works. Before doing so the management placed the position frankly and fully before the men, and the workmen were deeply impressed and agreed to work straight piecework, since when output had been satisfactory and no complaints had been received from the workmen or their representatives. Earnings vary from 33⅓ to 75 per cent. over time rates, and cases of 100 per cent. were not unknown. The management stated they were strongly opposed to cutting prices, as such action resulted in destroying the confidence of the men and hindered output.

*Case* 3.—The system of payment throughout the works is straight piecework. The Committee were of opinion that the workers were trying to obtain the maximum output. There was no difficulty in keeping the workpeople at work until the proper leaving-off time. Piecework earnings for machinists range from 50 per cent. to 75 per cent. above time rates, and for boilermakers practically 100 per cent.

*Case* 4.—Generally the method of remuneration of the workpeople throughout the works is as follows :—The ironworking trades of the shipyard department are on straight piecework to prices set out in the Clyde piecework price list. The mechanics' department and the brass-finishers in the shipyard are on a premium bonus. The whole of the general labourers and platelayers are on premium bonus. The stagers are on straight piecework to lists mutually arranged in the works. The helpers to platers in the ironworking department are on enhanced time rate when the plater is employed on piecework. The sheet iron workers, after a period of over two years on straight piecework to prices mutually fixed with individual workers, have reverted to plain timework, which has resulted in a considerable diminution of output from that department. The electricians, after a period of over three years on premium bonus, have reverted to plain timework, with very considerably diminished output and earnings to the workers concerned. All the other trades and departments in the shipyard have from time to time been approached to adopt some system of payment by results, but so far no agreement had been arrived at. The engine department and engine shops are on premium bonus throughout. In the boiler shop the workpeople are on straight individual piecework. In the engineering section of the locomotive and gun-mounting department, both straight piecework and premium bonus are in operation. The boilermaking section of this department is on straight piecework. Where premium bonus is in operation in the establishment the "Halsey" system is the one adopted.

*Case* 8.—Direct piecework has been the custom at these works for about thirty-five years. To-day the earnings of the pieceworkers vary from 40 per cent. to 90 per cent. above the basis time rates.

*Case* 9.—It was stated that about half the shipwrights were working on piecework and were earning considerably more money than those employed on timework.

*Case* 10.—In the boiler shop the boilermakers work piecework and have done so for a considerable number of years. The other departments are now working on plain time. The moulders were then considering proposals for some system of payment by results, and the firm think it will probably be agreed to. The foundry dressers will follow the decision of the moulders. With regard to the other departments, attempts had been made from time to time to introduce a system of payment by results, and, though it is believed that a large number of the men are favourable, nothing had been done owing to the opposition of the District Committee.

*Case* 6.—The Committee were informed that piecework was in operation in the boiler shop and part of the fettling shop, but that in the machine shops, erecting shops and electrical departments, work was entirely on time. A system of piecework had been in operation in the machine shops and erecting shops, but was discontinued owing to a change in the type of steam winches built.

*Case* 11.—Until two years before the visit, it was the custom in the machine shop to work on time, despite efforts made from time to time to introduce some system of payment by results. In the last two years a tonnage system had been introduced, but, so far, not with full success, owing, in the opinion of the management, to the objection of men to proposals to increase speeds and feeds. In the foundry timework alone is in operation, the men refusing an offer for a tonnage system. In the fettling shop payment is on a tonnage basis. With regard to the foundry, the management stated that the men would not accept any system of payment by results, as their union opposed the principle of piecework.

*Case* 16.—Machine shops are on time, all efforts to introduce payment by results being ineffective, though it was felt that the majority of the men themselves were in favour of it. In the foundry a system of collective piecework is in operation. It is felt that this system does not stimulate extra individual effort in the same way as individual piecework.

*Case* 12.—Machinemen, fitters, erectors, boilermakers and wagon builders are mainly paid under a system of piecework. In the erecting shop a collective system of piecework is in operation. There are five gangs, each composed of from ten to twelve men and boys, who share in one price. In the machine shops the average piecework earnings show an increase over time rates of about 40 per cent., and in isolated cases 75 per cent. increase and double time are earned. In the case of riveters and other men on

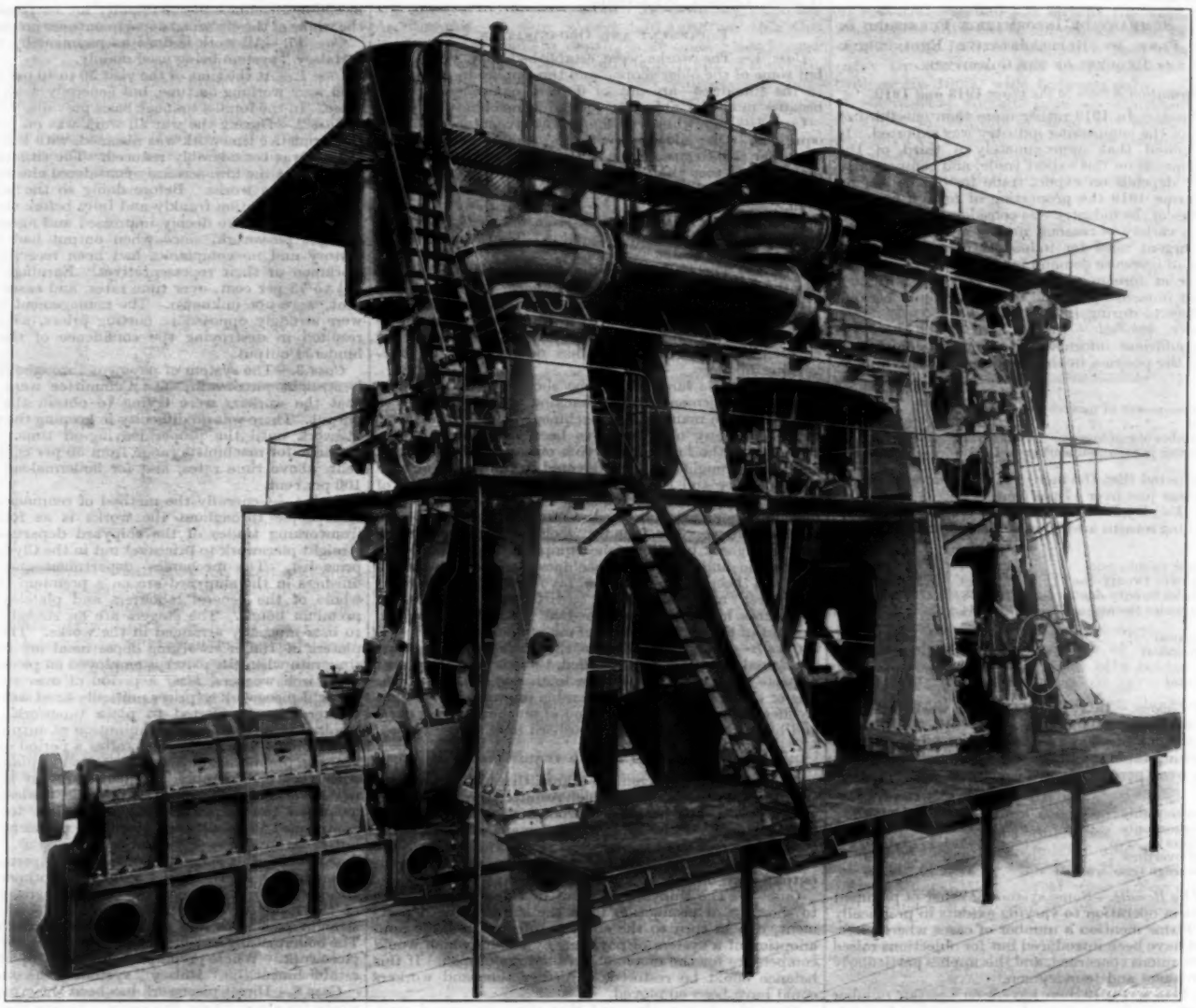
* No. I. appeared October 6th.

† This section is largely devoted to very brief comments on the shops visited. We abstract only such phrases as appear to us to have significance. The case numbers, inserted by us, do not agree with the alphabetical order of the names of firms visited; but where similar case numbers are given, they refer to the same firm.

# THE ENGINES OF THE S.S. CITY OF NAGPUR

**WORKMAN, CLARK AND CO., LIMITED, BELFAST, ENGINEERS**

*(For description see opposite page.)*



boiler work the earnings average about 40 per cent. In the foundry a bonus system on tonnage has been in operation for some time, and has had the effect of increasing output in certain classes of work.

*Case* 17.—Machinemen work on time, as it has not been possible to come to some arrangement for a system of payment by results. In the foundry a tonnage bonus is in operation on similar lines to the one at the works of Case 12.

*Case* 7.—In all the machine shops the method of payment is by piece. In the foundry the method of payment is by time with a tonnage bonus.

*Case* 14.—The shipyard was out of balance owing to inability to obtain sufficient numbers of shipwrights, plumbers and joiners, but the unions, though unable to supply the men, absolutely refused to consider any system of payment by results in the departments concerned for the purpose of bringing about the requisite balance of output.

*Case* 15.—In the ironworking sections some of the men are on piecework. The shipwrights, however, unlike other Tyne shops, were not working on piecework, the men in this case refusing to adopt it. With the exception of the boiler shop, the engine department was working on plain time. The firm had been considering the introduction of payment by results, but did not put it into operation owing to the manner in which the system had been resisted by the District Committee.

### Efficiency of Production.

*Case* 16.—The management stated that, with the change in hours, rates had been altered in the proportion of 47 to 54, and the men were drawing practically the same money, thus showing that their output had declined roughly in proportion to the reduction in hours.

*Case* 1.—It was stated that it was difficult to say what the effect of the introduction of the 47-hour week had been on output, because they had been very much hampered through difficulties with materials. He was of opinion that the men, if they liked, could turn out as much in the 47-hour week as in the 52 hours.

*Case* 2.—During the war piecework was worked. At the end there was a change over from piecework to timework, with the result that output was considerably reduced. After the matter had been placed before the workpeople they agreed to go back to straight piecework, since when the output has been satisfactory. Earnings from piecework are anything from 33⅓ per cent. to 100 per cent. above time rates. One of the directors stated he was satisfied that the workpeople were doing their best, and said he could not answer definitely whether output was equal under the 47 hours to what it had been under 53. They had been hampered by shortages of material which made it difficult for them to judge satisfactorily the effect of the change of the hours.

*Case* 3.—The speed of operation of the machines was high. The system of payment throughout the works is straight piecework. The Committee were of the opinion that all the pieceworkers were trying to obtain a maximum output and they worked right up to stopping time. Piecework earnings averaged 50 per cent. and 75 per cent. above time rates, and for boilermakers practically 100 per cent. When the supply of hydraulic power was limited it was necessary to work three shifts of 42½ hours, and the men succeeded in earning as much in the 42½ hours as previously in 47. The management had tried to introduce the three-shift arrangement in another department, but the men would not agree.

*Case* 4.—The fact that many departments had changed over from piecework to timework makes it difficult to say what was the effect of the reduction in hours, but there is a serious diminution in all these departments where there had been a change over from piecework to timework.

*Case* 5.—The management stated that output had fallen in proportion to the reduction in hours, viz., 54 to 47.

*Case* 18.—The management stated that the output had been reduced in proportion to the reduction in hours of labour, *i.e.*, to 47/53rds of what it had been before the reduction.

*Case* 8.—It was stated that a reduction in working hours had led to a drop in output of 20 per cent. They had some difficulty with materials, but this had never been serious enough to hinder output. As an example of the reduction in output it was stated that in 1913, 100 single-ended boilers were turned out, as against 80 in 1919, the size and type being the same in each case.

*Case* 9.—This firm stated that the output to-day was 25 per cent. less than in the pre-war period, but part of this was due to bad timekeeping. The riveters had only averaged during the month of March, 1920, about 38 hours, if anything, worse than in the same month of 1919. Half the shipwrights were on piecework and were earning considerably more than others on timework. The change over to piecework had followed the introduction of the 47-hour week, and in consequence it was felt that output was better than immediately prior to the change.

*Case* 10.—The management stated that the present weekly output was about 47/53rds of the pre-war weekly output.

*Case* 6.—The men working on time appeared to be working well and with a good spirit. Owing to the careful organisation of the main machine shop for repetition work and to the good spirit which prevailed, the managing director thought a fair rate of output was being obtained, though it was not equal to 1913. With regard to the moulding shop, despite the erection of additional bays, the installation of a large number of moulding machines and improved crane equipment, the output was less than in 1913 to an extent which cannot be explained by the reduction in working hours alone. Apparently the men were not desirous of increasing their earnings beyond a certain amount. The restriction of output in the foundry prevented the employment of more people in the machine shops. The relationship between the firm and the employees appeared to be very satisfactory.

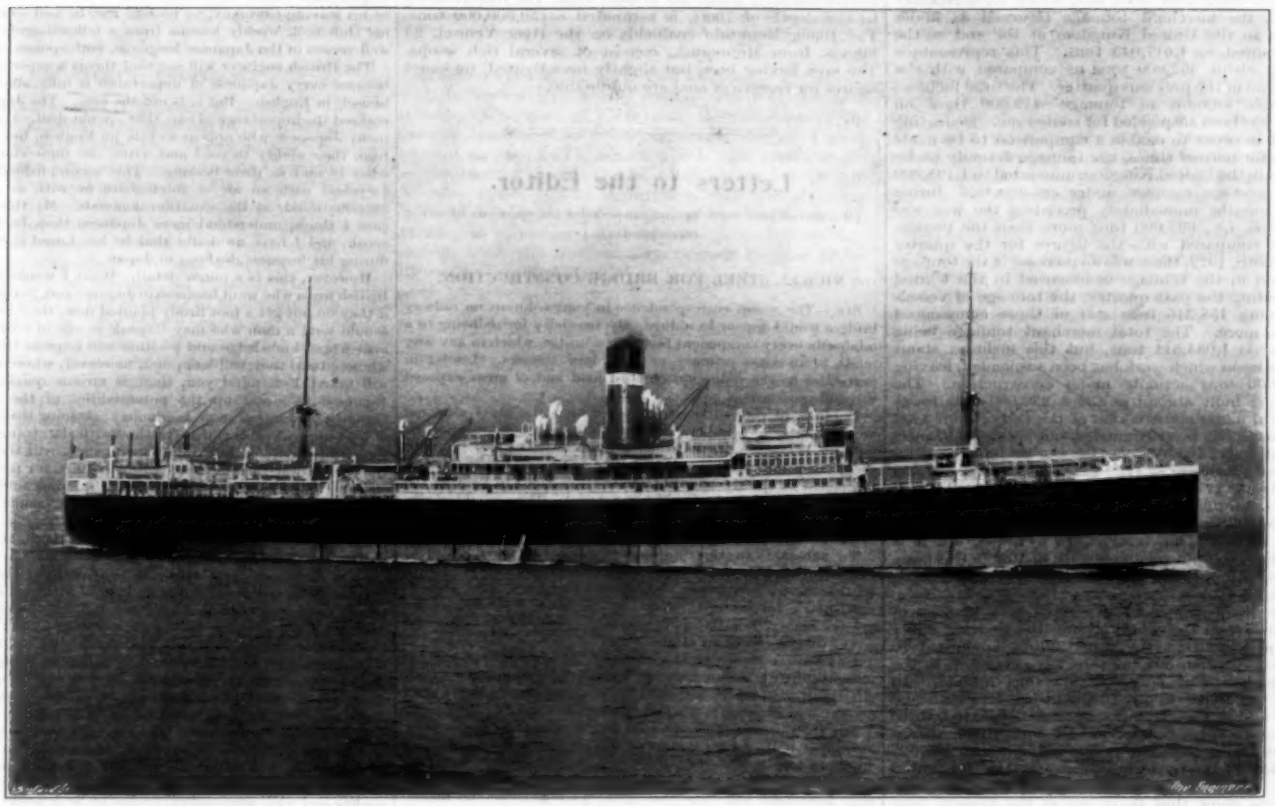
*Case* 11.—It was stated by the management that it was very difficult to make definite comparisons between output now as compared with 1913, but in certain cases the same men in the foundry are taking 50 to 100 per cent. longer to do identically the same jobs than they took in 1913. As regards machining, a large amount of work is taking 25 per cent. longer now than in 1913, though facilities are better. The management attributed this to psychological reasons, but lack of materials had affected them also. Recently, however, there had been signs of improvement.

*Case* 7.—The management stated that in 1913 a certain type of machine could be manufactured in four weeks, whereas in 1919 it took at least six weeks. They stated that output had gone down to a greater extent than could be accounted for by the reduction in working hours. Their foundry is the bottle neck, and the number of employees there had declined from 158 in 1913 to 122 in 1919. The shortage of castings was preventing the employment of more workpeople in other departments. The firm has practically no competition in the home market, and has had little in the past abroad, but America and Germany are becoming strong competitors.

*Case* 13.—The management stated that so far as piecework men were concerned, the change from the 53 to the 47-hour week had made no difference to output, because the number of actual hours worked had not changed. So far, however, as men working on time were concerned, output had decreased by 10 per cent. The Committee were much impressed by the general slackness of the men employed throughout the whole establishment, and this was particularly marked in the case of the engine shops, where few men appeared to be working well. The best effort was being put forward by the workers in the boiler shop, where men were working on straight piecework. The establishment was out of balance owing to a considerable shortage of shipwrights, plumbers and joiners,

# THE ELLERMAN LINER CITY OF NAGPUR

WORKMAN, CLARK AND CO., LIMITED, BELFAST, BUILDERS



and despite the efforts of the firm and of the unions concerned it had not been possible to obtain the number required to balance the establishment. The unions concerned refused to entertain a system of payment by results in order to secure increased output. Under the Restitution of Pre-War Practices Act the firm had been obliged to revert from the premium bonus system to plain time in the case of joiners, plumbers and bricklayers. In the case of bricklayers the result had been a drop from 800 bricks to 350.

*Case* 15.—In the dry dock department it appears that the time taken for an ordinary docking, including cleaning and painting of outer bottom, withdrawal of tail shaft for examination and replacing of same, which formerly occupied three tides, *i.e.*, thirty-six hours, now took seventy-two hours. The men were now working about the same hours per week as when the 53-hour week was in operation, and so far as pieceworkers were concerned the output per week had not materially altered, but there had been a considerable reduction in output so far as time-workers were concerned. It was stated that a large number of men were satisfied with the money they could earn, and therefore did not give the full output that could be obtained in the 47-hour week.

## The Liner City of Nagpur.

The liner City of Nagpur, recently completed by Workman, Clark and Co., Limited, for the City Line fleet of the Ellerman Lines, Limited, left the Mersey on Saturday last, the 7th inst., on her maiden voyage under the command of Captain Sir James R. Rae.

This steamship, an engraving of which we reproduce above, has been specially designed and equipped for passenger service between Great Britain and India. She is over 490ft. in length, has a tonnage of 10,200 tons, is of the shelter-deck type, and has been built under special survey for the highest class in Lloyd's Register and so as to fulfil the latest requirements of the British Board of Trade for a first-class passenger and cargo steamer. In accordance with the company's practice, the vessel has a cruiser stern, which, compared with the ordinary stern, gives an increase of 11,800 cubic feet of space and a gain of 2300 square feet of deck space for the same perpendiculars.

The vessel is fitted with the latest approved safety appliances, close-spaced water-tight bulkheads carried up to the superstructure deck, wireless telegraphy, and boats for all, the boats being handled by mechanically operated davits. An emergency dynamo is fitted on the boat deck which is capable of carrying on the lighting and wireless service. This dynamo also supplies power for driving an electrically operated emergency service pump.

Accommodation is provided for 226 first-class passengers in state rooms arranged amidships on the upper, shelter and promenade decks, whilst 92 second-class passengers are accommodated in state rooms on the upper deck. The public rooms are also situated on these decks, and are very commodious. Special features of the ship are her covered passenger promenade decks, while a large section of the promenade deck space on either side of the forward end abreast the lounge is enclosed by a steel screen in which large sliding windows have been arranged so as to form an open-air lounge. The heating, ventilation, and lighting throughout the ship has been given special attention. The vessel has six hatches served by a total of sixteen derricks, including one for heavy lifts, which are operated by fourteen steam winches. These winches, which are situated near the passenger accommodation, are of a special silent type in order to avoid the vibration and noise which is generally associated with that class of machinery. All the cargo holds are built on the wide-space pillar and girder principle.

The propelling machinery, which was supplied by the builders of the vessel, consists, as will be seen from the engraving reproduced on page 378, of a set of quadruple expansion engines, balanced on the Yarrow-Schlick and Tweedy system. The cylinders are 29in., 42in., 60in., and 86in. diameter by 60in. stroke, and the engine is designed to develop 6000 indicated horse-power at 82 revolutions per minute. A Ramsay patented governor is provided, and the reversing gear is of the steam hydraulic type. The thrust block is buttressed against the main engine bedplate and the thrust collars are of the ordinary design with forced lubrication. Steam is supplied by five single-ended multitubular boilers, 16ft. 6in. diameter by 12ft. 6in. long, working at a pressure of 230 lb. per square inch, Schmidt type superheaters and Howden's forced draught being fitted. The furnaces are arranged to burn either coal or oil separately, or oil in conjunction with coal, the Wallsend-Howden system of oil fuel burning being installed. The main air pump, the bilge and sanitary pumps, and the thrust block forced lubrication pump are worked by the main engines, whilst the main centrifugal circulating pump is driven by a single-cylinder steam engine. The main and auxiliary feed pumps and feed heater were supplied by G. and J. Weir, of Cathcart, Glasgow, the ballast, general service, sanitary, fresh water and hot salt water pumps are by Thom, Lamont and Co., Limited, of Paisley, and the evaporator and feed filter by Hocking and Co., Limited, of Liverpool.

## The Institution of Automobile Engineers.

In his presidential address before the Institution of Automobile Engineers, the newly elected President—Colonel D. J. Smith—warned the members that under the present condition of affairs they must not allow themselves to be entirely engrossed in the technical aspect of the motor car, as were Hancock and Gurney, but that they must also keep an eye on the many other questions which, though perhaps not directly connected with the motor car itself, nevertheless might have a very great effect on the well-being of the industry. He pointed out that the automobile engineer, before deciding as to the car which he would build, the quantities he would produce, and the plan he would install to produce them, must first of all consider what market he would have. He then showed that at the present time the normal output of the motor car manufacturing firms in Great Britain would be nearly four times the absorption capacity of the country, entirely excluding imports, while Canada, for instance, could produce more still, and the United States could supply the demand of the whole world.

From this basis Colonel Smith urged upon automobile engineers the necessity of taking a wider view, not being content to design a car which would run on the comparatively good roads in this country, but that they should ascertain the local conditions in the various component parts of the British Empire, and design a car to meet those conditions, and make an earnest endeavour to capture those markets. In connection with the demand for commercial vehicles, he made the rather startling statement that, with the exception of two special types, there was no need to order a single vehicle from abroad during the war, adding that the huge surplus of vehicles which was actually ordered would be for years an incubus on the British commercial motor car industry. He expressed the belief that the chief development in Great Britain would lie in the direction of vehicles carrying fourteen to sixteen people and luggage, which could compete with railways by providing rapid and frequent passenger service from door to door, and so tending to open up rural districts in a manner hitherto uncontemplated.

In referring to the all-important question of roads, Colonel Smith expressed the hope that automobile engineers would not only take a greater interest in the subject, but that automobile engineers might be placed in positions where they would have a more direct influence upon the methods of road construction. He pointed out the absurdity of the present conditions, under which the construction of roads was often used as a means of helping the unemployed, and instanced the practice of railway companies, in which the designers of the vehicles worked in the closest touch with the designers of the road to carry those vehicles. Discussing the capacity of highways, he asserted that a tramway service with five-minute intervals reduced the carrying capacity by 50 per cent., while a two-minutes' interval would reduce its capacity by 80 per cent., resulting in an indirect loss, amounting in London alone to millions of pounds. After urging members, not only as automobile engineers, but as taxpayers, to fight strenuously against the attempt of the London County Council to obtain powers to prevent any vehicle passing a tramcar when it was stopped for setting down or picking up passengers, which, if granted, would encourage other municipalities to seek the same sort of powers, and which would virtually paralyse all other traffic, he stated that "the comparatively early disappearance of the tramways is certain, the country cannot afford them."

Colonel Smith then expressed the opinion that the speed of motor traffic could not be limited for all time, and that in order to obtain the full benefits from the possibilities of motor traffic, speeds must be increased and special accommodation must be made for foot passengers, such as bridges or fixed crossing-places, the use of which would be made compulsory, adding that "not the immediate cost, but the ultimate saving must be the determining factor."

In dealing with the all-important subject of fuels, Colonel Smith urged that automobile engineers should widen their view, and not consider liquid fuel as the only fuel available. He pointed out that in many countries charcoal is available at prices which make it equivalent to petrol at a few pence per gallon. He pleaded with automobile engineers to design vehicles suitable for such fuels, especially on the lines of a steam vehicle of a lighter type than those generally seen.

The address concluded with the following words:—"Automobile engineering is yet in its infancy; no one can visualise what its extent will be in, say, twenty years' time, and it is therefore necessary to pay attention without delay to matters which, even now, are beginning to retard its growth. Cheap, rapid and efficient transport is vital to social improvement, and the motor vehicle can and will provide this. The benefits conferred by the railways will be as nothing to those conferred by the motor vehicle. The future of transport is in the hands of automobile engineers, and by their combination in this Institution they can mould the future as they desire."

## A Quarter's Shipbuilding.

In Lloyd's Register Shipbuilding Returns for the quarter ended September 30th last, which have recently been issued, the merchant tonnage returned as under construction in the United Kingdom at the end of the month amounted to 1,617,045 tons. This represents a reduction of about 302,000 tons as compared with the total at the end of the previous quarter. The total includes a considerable amount of tonnage—419,000 tons—on which work has been suspended for some time. Deducting this amount in order to enable a comparison to be made with figures for normal times, the tonnage actually under construction in the United Kingdom amounted to 1,198,000 tons. The average tonnage under construction during the twelve months immediately preceding the war was 1,890,000 tons, *i.e.*, 692,000 tons more than the present figures. As compared with the figures for the quarter ended June 30th, 1922, there was an increase in the tonnage launched and in the tonnage commenced in the United Kingdom during the past quarter, the tonnage of vessels launched being 158,346 tons and of those commenced 43,551 tons more. The total merchant tonnage being built abroad is 1,085,511 tons, but this includes about 256,000 tons upon which work has been suspended, leaving about 829,000 tons actually under construction. The tonnage being built abroad is about 230,000 tons lower than the total under construction at the end of June last. The decrease affects most countries, but specially France, Holland and Italy. The figures for the leading countries abroad are:—Italy, 210,114 tons; France, 197,065 tons; Holland, 177,024 tons; United States, 147,056 tons; and Japan, 96,897 tons. The above figures do not take into account the tonnage being built in Germany and at Danzig, for which no returns are available, but it is estimated that the tonnage under construction in Germany at the present time is about 350,000 tons, and at Danzig 40,000 tons.

From the table showing the number and tonnage of vessels launched in the world during the quarter under review, it appears that the total figures amounted to 476,070 tons, of which 307,232 tons were launched in the United Kingdom and only 168,838 tons abroad. In addition to the above, about 100,000 tons were launched in Germany and at Danzig, but, as previously stated, these figures are only approximate. The tonnage commenced in the world during the same period amounted to 187,527 tons, of which 82,428 tons were commenced in the United Kingdom.

The returns show that there are at the present time 62 steamers and motor vessels, each of over 1000 tons, with a total tonnage of 391,245 tons, under construction in the world for the carriage of oil in bulk. Of the total, 47 of 306,971 tons are under construction in the United Kingdom. The tonnage of vessels now being built which are to be fitted with internal combustion engines, amounts to 241,622 tons.

Of the vessels given as being under construction in the world—excluding vessels the construction of which has not actually been commenced and also all vessels of less than 100 tons—389, of 1,640,425 tons, are under the inspection of the Society's Surveyors, with a view to classification in Lloyd's Register Book. In addition, 66,000 tons are being built to the Society's classification in Germany.

## COAL AND IRON IN SIBERIA.

The following particulars of some of the mines of Siberia have been compiled by the Geological Survey of Russia and issued by the Soviet Government.

The Kuznetsk coalfields occupy the first place in Western Siberia as to the quality and amount of coal and to general industrial prospects. The valley, which measures about 22,000 square kilometres, is intersected by the navigable river Tom and its tributaries, and contains six coal deposits. The total width of the coal seams reaches 319ft., while that of the carboniferous strata is 24,500ft. Consequently, the proportion of coal in the Kuznetsk area is 1.3 per cent. In certain fields this figure advances to 1.8 per cent., reaching 16 per cent. in the Kemer field.

According to recent investigations, the total reserve of coal in the Kuznetsk coalfields is 250,000,000 tons, being half the reserve of the whole territory of the Soviet Republic. These coals are of high quality, containing as they do little sulphur and only 2.5 to 6 per cent. of ash. In the Kemer field in particular a coking type coal is found. Development of this area began in 1914, and during that year 420,000 tons of coal were produced.

The Telbes iron ore deposits, situated 80 kiloms. south of Kuznetsk and connected by railway with the collieries of that area, offer large opportunity for establishment of metallurgic industry. The Telbes River area comprises nine deposits, of which only three have been more or less explored. In accordance with the latest investigations, the actual reserve of this area is estimated at 11,000,000 tons and the potential reserve as 15,000,000 tons. The ore is of very high quality, containing 60 to 63 per cent. of iron. The ore-bearing body lies only 210ft. from the surface. In view of the fact that these deposits can be very easily exploited, contain ore of high quality, and lie close to deposits of coking coal, the Kuznetsk Mining Company at one time proposed to build an iron foundry for the production of 500,000 tons of cast iron per year, but, unfortunately, this plan could not be realised.

The Ekibastooz deposit of coking coal consists of several seams, of which only four are opened. The reserve of these, down to the depth of about 6500ft., approximates 500,000,000 tons. The deposit is about 100 kiloms. from the river Irtish, with which it is connected by a railway.

The Ridder zinc deposit on the Irtish is very easily reached from Ekibastooz. According to investigations made in 1916, the reserve of zinc ores reaches 2,500,000 tons. The contents are: Zinc, about 15 per cent.; lead, 8 per cent.; copper, 1 per cent.; gold, 0.002 per cent.; silver, 0.016 per cent.

The Irbit and Abakan iron ore deposits, situated in the area of the river Yenisei, have been but slightly investigated. The reserves of these deposits are estimated as 8,000,000 tons and 1,500,000 tons respectively, with contents of 65 per cent. of iron. No doubt more detailed prospecting will result in much larger figures for both actual and potential reserves.

The Izikh coalfields on the river Abakan consist of twelve workable seams 3ft. or more wide. The reserve down to the depth of 700ft. is estimated as 50,000,000 tons. The Black Mountain coalfields on the river Yenisei, 25 kiloms. from Minussinsk, consist of several rich seams. The area having been but slightly investigated, no exact figures for reserve of coal are obtainable.

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### NICKEL STEEL FOR BRIDGE CONSTRUCTION.

Sir,—The recent correspondence in your columns on railway bridges would appear to indicate the necessity for reducing to a minimum every component factor in a bridge, which in any way tends to increase primary or secondary stresses. I refer in particular to the reduction of dead load and of areas exposed to wind pressure.

It must, of course, be remembered that the cross sectional area of certain members subject to compression cannot be reduced below a critical value, lest buckling occur; but with those exceptions designers of carbon steel bridges are constantly compelled to specify unduly large cross sections in view of the relatively low stress limit of the material. They would gladly utilise a stronger alloy steel and so reduce weight, but memories of past commercial considerations thwart their desire.

To substantiate this statement, I quote from "Student I.C.E.'s" letter in your issue of September 29th, 1922:—"With regard to new materials, nickel steel has been used abroad, particularly in America, where, by the way, working stresses are far higher, but this is again very expensive and the cost *versus* weight comes up at once."

Has your correspondent examined the economic aspect at present prices? As an example, let us take the case of a simple alloy steel, say, 3 per cent. nickel steel containing 0.25 per cent. carbon, and compare it with a plain carbon steel.

For the purpose of comparison let us take the present price at rolling mills for carbon steel, plates, angles, tees, &c., as 190s. per ton.

Metallic nickel is quoted at £140. The alloy steel without heat treatment will thus cost 190s., plus 84s. for the nickel, to which must be added an allowance for the slightly higher value of unserviceable scrap. Equal rolling costs are assumed.

To obtain the best results from the alloy steel it will be necessary to subject the material to heat treatment, the cost of which, together with that for cutting, drilling, punching, &c., and delivery on site, might make the total cost of the nickel steel 600s. ton on site ready for erection.

In like manner, but allowing a slightly lower figure for cutting, drilling, punching, &c., the carbon steel (although the total freight on the carbon steel will, in view of the greater quantity required, be higher than on the alloy steel), a comparative figure for the carbon steel might be 300s. per ton on site ready for erection.

It will thus be seen that for the same price as one ton of carbon steel, delivered on site ready for erection, it would be possible to use under the same conditions one half ton of nickel steel. In considering the final "cost on site" the figures for the two materials under comparison are entirely arbitrary, but the ratio of cost would not be appreciably affected even were these figures both somewhat higher.

Let us now compare with this cost ratio the relative weights of carbon and alloy steel respectively which would be required for the erection of similar structures. It is, of course, not suggested that carbon steel should be replaced by nickel steel for every part of the structure, but only for those portions where its adoption is clearly beneficial.

To give a 20 per cent. elongation the yield point of the alloy steel in the heat-treated state can be taken as 35 tons per square inch, and that of the carbon steel as 20 tons per square inch. If the allowable increase of stress is taken as 35 : 20 and the live load be small compared with the dead load, the *theoretical* weight of a bridge made of nickel steel need be only $\frac{(20)^2}{(35)} = 0.33$ of the weight of the same bridge made of carbon steel. It would be extreme to take this figure as the weight reduction ratio, but 0.5 might be allowable.

Under these purely comparative assumptions the cost of a bridge made of a combination of 3 per cent. nickel and carbon steel works out at a lower figure than one constructed throughout of carbon steel.

F. B. Howard White.

London, October 9th.

### JAPANESE TRADE.

Sir,—I hesitate to write to you on matters which must appear to be extremely commonplace, but as a traveller who has spent a short time in Japan a few matters appear to be obvious to myself and yet not altogether to be appreciated by the people at home.

Time and again, I have been told that the Japanese would send their orders to British firms if only there were someone to turn to. As it is, many big concerns appear to have no technical men on the spot, depending perhaps for their business upon agencies which have no technical knowledge and which consequently carry no weight in the opinions of their would-be customers. America, on the other hand, has many representatives in the country, and she will think nothing of sending over at short notice a technical expert from the States, who has received full information before starting as to what conditions he may expect to find.

Germany, too, who was powerfully entrenched in Japan before the war years came with upheaval in their wake—Germany is also sapping her way back into her old positions. Many of the leading electrical engineers of Japan have been educated in Germany, speak German, and make no disguise of the fact that they like and admire the German and his methods. As I write from boardship in the middle of the Pacific Ocean, I am not sure that I altogether disagree with them. A diplomatic steward—an American—has seated me at table next to a Prussian who during the late war was engaged in making chlorine gas for the benefit, amongst others, of myself. He is now representing a big German firm of engineers in Japan. He is a charming man, a good scholar, and, I should think, able. Already, after one year's residence in the country, he has a far finer working knowledge of the language than the average Englishman would have acquired. For some time previous to his leaving Germany, so he told me, he and some others of his club took weekly lessons from a fellow-member who was well versed in the Japanese language, both spoken and written.

The British engineer will say that this is a superficial matter, because every Japanese of importance is fully able to express himself in English. But it is not the case. The Japanese have realised the importance of ears that are not deaf. One will meet many Japanese who appear to talk no English, but who, apart from their ability to read and write, can understand much of what is said in their hearing. This accomplishment may be exercised with an air of intelligence or with an apparently vacuous mind, as the situation demands. My German friend can, I think, understand more Japanese than he can readily speak, and I have no doubt that he has found it of great use during his business dealings in Japan.

However, this is a minor detail. What I would urge is that British firms who want business in Japan—and, goodness knows, if they do not get a foot firmly planted now, they never will!—should send a man who may "speak as one in authority"; a man whose knowledge and position will impress the Japanese, whose advice they will seek, and, moreover, whose advice they will take. For, mind you, there is no one quicker than the Japanese at sizing up the potentialities of the chance-met foreigner, and no one more assiduous at gleaning the last pickings of his brain. As this is their method with the stranger of whom they know nothing, how much more, then, will they cultivate the representative of a famous firm—a director perhaps or an engineer expert in his craft? Whether that ambassador of trade choses to take the trouble of learning something of the country's language before or after arriving there, is a matter of individual choice; but if he is going to be there for any length of time it will be an undoubted asset.

That there are great opportunities awaiting the assiduous searcher, who can doubt when we hear of a British firm quietly taking from under the unsuspecting and self-confident nose of America a contract for some two millions sterling? But the electrification of the Tokkaido Railway is only one of the great movements ripening in Japan. Attention is being turned to the roads, which at present are inadequate in quality and numbers. Underground Railways, too, are being seriously discussed, both for Tokyo and for Osaka.

Let not the "travellers" who come to Japan regard Japan as a subsidiary field to China, as did one gentleman of the road who had disposed of all his samples of belting in the latter country; for naturally enough one who travels in such a commodity and who, when asked, proves to be deficient in samples, can hardly be expected to command the respect of the Japanese people. I hesitate to mention such a platitude, but Japan is a far cry, as the mail-bag crawls, from a base in England.

In fine, let me say that Japan is quite a different proposition from China. The people here know quite well what they want, and they know the good from the bad; moreover, they are prepared, if necessary, to pay the higher price for material which they know to be of higher quality. In one tin-can factory, for instance, tin-plates are being bought 20 per cent. dearer from the States, simply because recent experience has proved, so I was told, the British supply to be inferior.

Quick delivery is perhaps a tougher problem for the British competitor, but he must somehow wipe out the evil reputation in this direction which post-war years have given him throughout the Far East. Let the prospective visitor or resident take note before he leaves home of the conditions which will meet him, so that he does not emulate the man who, coming to represent milling machinery, was fully conversant with the requisites of a flour mill, but who had no word to say on the milling of rice.

Let good men come, and come quickly. A man of personality and knowledge, if he deals with the Japanese as with equals, will go far in this civilised country.

As I have said, this can only pretend to represent the ideas of a passer-through, but if you should care to publish an abridged edition of this letter, it might chance to stimulate the interest of such as have more knowledge.

An Out-land Voyager.

### TIMOTHY HACKWORTH AND THE LOCOMOTIVE: THE FIRST ENGINE FOR RUSSIA.

Sir,—Referring to the last paragraph of my letter published in your issue for March 24th last, it has been impossible under present conditions to obtain any further information from original contemporary Russian sources to show which was the first English-built locomotive to arrive in Russia.

References in English journals show that Hackworth's engine was shipped on board the Barbara at Middlesbrough on September 15th, 1836. The first Stephenson engine, according to its makers' records, was "sent to Russia" on September 21st, so that the two were to all intents and purposes contemporary, but Hackworth's engine had some priority.

From another contemporary source, it appears that practically the whole of the material for the railway was obtained in England, including the four locomotives ordered by von Gerstner, the engineer of the railway, one from Timothy Hackworth, one from Tayleur and Co., and two from Robert Stephenson and Co.

There is evidence that some of the engines—it is not specified which—had been tried by December, 1836, but the line was not opened until October, 1837, as shown by the Russian medal to which I have already referred. This medal bears on one side a remarkably fine representation of a Stephenson six-wheeled engine of the type patented by Robert Stephenson in 1833. Probably the Tayleur engine, like several others built by the same firm, was to Stephenson's design, Robert Stephenson being one of the original partners in the Vulcan Foundry.

There are records of spare parts supplied later by Robert Stephenson and Co. for all the above-mentioned engines sent to Russia.

Darlington, October 10th. J. G. H. Warren.

The presidential address for the ensuing session of the Association of Engineers-in-Charge will be delivered at 7.30 p.m. on Wednesday, October 11th, at St. Bride's Institute, Bride-lane, Fleet-street, E.C. 4, by Professor H. S. Hele-Shaw, D.Sc., F.R.S., upon "The Advantages of Incorporation."

# A Seven-Day Journal.

## Sir Henry Thornton.

THE announcement is confirmed that Sir Henry Thornton has accepted the position of president of the Canadian National Railways. These railways consist of the Canadian Northern, the Canadian Government, the Grand Trunk Pacific, and the Grand Trunk Railways, and have a total length of track of over 22,000 miles, or more than any other single railway system in the world. On one of them alone, the Canadian Government, there was a deficit last year of nearly 15 million sterling, so that Sir Henry will have a large field for the exercise of his organising and controlling abilities. Sir Henry was born at Logansport, Indiana, in 1871, and after studying at Pennsylvania University, entered the service of the Pennsylvania Railroad in 1894. In 1911 he became general superintendent of the Long Island Railway, on which he gained great experience in the handling of heavy traffic by electric traction. In February, 1914, he was appointed general manager of the Great Eastern Railway. This appointment represented the first occasion on which a British railway had found it necessary to go outside the country for a general manager, and was considerably criticised; but was defended by Lord Claud Hamilton on the ground that there was a lack of suitable rising talent in Great Britain. During the war Sir Henry was connected with the Inland Waterways and Docks Department, and later with that of the Director-General of Movement and Railways. In 1919 he succeeded Sir Eric Geddes as Inspector-General of Transportation. His salary with the Great Eastern Railway is stated to have been £6000 a year. His contract with the Canadian Government is for a period of three years and carries a salary of £10,000.

## Lord Claud Hamilton.

ALMOST simultaneously with the announcement of Sir Henry Thornton's new appointment, the news was published that Lord Claud Hamilton intends to resign his position of chairman of the Great Eastern Railway in the near future, probably at the end of the year. Lord Claud is now in his eightieth year and feels that the increased duties likely to be thrown upon him as a result of the amalgamation of the Great Eastern with the Great Northern, Great Central, North-Eastern, North British, and Great North of Scotland Railways to form the Eastern Group should be undertaken by one of less advanced age. He joined the board of the Great Eastern Company in 1872 and two years later was elected deputy chairman. He has held the position of chairman since 1893. In the course of his fifty years of service on the board he has seen many developments in the system and has himself played a prominent part in taking the steps which led up to them. The institution of a rapid and efficient continental service is in particular the outcome of his untiring energy and business perspicacity. He is a firm believer in the great possibilities which the new grouping system affords for economical working, but he strongly emphasises the fact that the benefits to be derived will only be fully attained by highly efficient control and management.

## A Kent Coalfield Deal.

IN extension of our paragraph in last week's Journal, we have now to record that a new company, bearing the title of Pearson and Dorman Long, Limited, is being formed by S. Pearson and Son, Limited, and Dorman, Long and Co., Limited, with a capital of half a million sterling, for the purpose of developing the coal-bearing lands in Kent owned by the latter firm. Among the directors are Sir Hugh Bell, Sir Arthur Dorman, Lord Cowdray, Sir C. G. Hyde, Colonel F. J. Byrne, and Sir Edward Pearson. The Kentish coal companies with which Messrs. Dorman, Long have been in negotiation for the purchase of additional areas of coal and mineral-bearing lands in the county, have assented to the ratification of the agreement to grant the leases, a small minority only of the shareholders expressing disapproval.

## The Old London Bridge Arch.

ON Monday morning a deputation representing the Society for the Protection of Ancient Buildings waited upon Sir Robert McAlpine, head of the firm of contractors responsible for the erection of the new office premises at the north end of London Bridge. The object of the deputation was to discuss the position regarding the preservation *in situ* of the arch of old London Bridge disclosed during preliminary excavation work about eighteen months ago. The demolition of the arch has been delayed with a view to discovering whether it could not be permanently preserved in its original position; but as neither the City Corporation nor the Bridge House Estates Committee appeared to be able to assist in the matter, and as delay in effecting demolition was involving considerable expense, it had been decided, Sir Robert said, to proceed with the pulling down of the arch at once. The cost of preserving the remnant of the ancient structure as it stood would, he explained, amount to about £11,000, of which sum £4000 would be required to recoup the building owner for the loss of cubic space. The deputation did not associate itself with the idea of removing the arch and re-erecting it elsewhere, as has been proposed in connection with the forthcoming British Empire Exhibition at Wembley Park.

## H.M.S. Lion to be Broken Up.

A STRONG desire having been expressed that the battle-cruiser Lion, in view of the memorable part which she played in the war, should be preserved as a national relic, the Admiralty has announced that, while it shares in this feeling, the Washington agreement definitely names the vessel among those which are to be completely broken up within eighteen months of the ratification of the Treaty. Apart from this consideration, it is pointed out that the cost of preserving the vessel in the proposed manner would be very considerable, for the fact must be faced that steel vessels, unlike wooden, require constant expenditure on their upkeep even while lying at anchor. It is probable that some relics of the ship may be perserved for public exhibition. The Lion was launched at Devonport in August, 1910, and took a leading part in the Heligoland and Dogger Bank actions and in the Battle of Jutland, in which she was severely damaged.

## Wages and the Cost of Living.

FURTHER support is being given to the view held by some manufacturers and employers of labour that the regulation of wages by the cost-of-living index figure yields unsatisfactory and harmful results. The Glasgow Chamber of Commerce has recently been sounding the opinion on the point of other similar bodies in the kingdom, with the result that its views have been endorsed by a large majority of those with which it communicated. On the 18th inst. the Association of British Chambers of Commerce is to meet at Leicester, and on that occasion the Glasgow body is to propose a resolution declaring that the adjustment of wages by the index figure produces unfair inequalities in the wages of workmen, handicaps us in international competition, restricts employment and impairs our national prosperity. An inquiry into the matter is to be suggested as an urgent requirement.

## Shipbuilding Employers' New President.

AT the annual meeting of the central board of the Shipbuilding Employers' Federation at Edinburgh, on Tuesday, Mr. Leonard Ropner, of the Ropner Shipbuilding and Repairing Company, Limited, Stockton-on-Tees, was elected president in succession to Mr. James Lithgow, of Lithgows, Limited, Port-Glasgow. Mr. Grant Barthey, of the Caledon Shipbuilding Company, Dundee, now becomes senior vice-president, while Mr. John Barr, of Vickers Limited, Barrow, has been elected junior vice-president.

## The Shipyard Ballot.

AS was anticipated, the ballot of the shipyard workers on the proposal of the employers to withdraw the remaining 10s. per week of the war bonus has resulted in a large majority of the men voting in favour of empowering their representatives to make the best terms possible. The number voting in favour of this alternative was 57,824. For accepting the proposed reduction the votes recorded were 7148, while for resisting it by means of a strike the number was 24,267. Having secured the abolition of 16s. 6d. of the weekly war bonus, the employers entered into a conference with the men's representatives about a month ago with regard to the withdrawal of the remaining 10s. Their case was that it would not be wise to stabilise wages at a level which would prevent work from being secured, and that if it could be said that wages had been reduced and then stabilised the effect on the ordering of new ships would probably be such as to permit many more men to be employed. The employers propose to make the reduction in four steps beginning on November 1st, so that little time is left for the unions to confirm by ballot the acceptance of the "best possible" terms arrived at with the employers.

## Sheffield Steel Products.

ON behalf of the debenture holders of Sheffield Steel Products, Limited, Sir William B. Peat, of W. B. Peat and Co., chartered accountants, London and Sheffield, has been appointed receiver and manager. It is believed that the business will be carried on under Sir William's management, and that the company will be reconstructed. Last June, it will be remembered, the directors found it necessary to issue a denial of a rumour to the effect that the works were shortly to be closed down for an indefinite period. Towards the end of August they sent a circular letter to the shareholders, reviewing the company's position and refuting certain rumours concerning it which were again in circulation. It was admitted in that letter that the activities of the company had been, and were being, restricted by the insufficiency of the support accorded by the public to an increase in its working capital last April. The company is a combination of several firms engaged in the Sheffield light trades. The opinion has been expressed that the price paid for some of the businesses absorbed was much too high. There can be no doubt that the action of the firm in December, 1921, in creating Sheffield Steel Products (Stores), Limited, with the object of dealing retail direct with the public aroused considerable ill-feeling among merchants and ironmongers.

## The Power Securities Corporation.

UNDER the title of the Power Securities Corporation, a company has been formed with a nominal capital of two million pounds sterling for the purpose, among others, of assisting financially or otherwise in the development of engineering and electrical undertakings. The first directors of the new company will be drawn from the directorates of the following companies:—Babcock and Wilcox, Limited, the British Thomson-Houston Company, Limited, Sir W. G. Armstrong, Whitworth and Co., Limited, and Balfour, Beatty and Co. The last-named firm is a private company with offices in London which carries on the business of electrical engineers, contractors and managers of electrical undertakings. The Corporation is to adopt an agreement with the partners in Balfour, Beatty and Co., the purchase consideration being £220,000. It will be recalled that last April a similar combine, with an initial capital of £250,000, under the title of the Power and Transport Finance Company, was formed by Cammell Laird, Sir Wm. Arrol, the English Electric Company, the North British Locomotive Company, John Brown and Co., and the Prudential Assurance Company.

## Broken Locomotive Connecting-rods.

DURING the week the Ministry of Transport issued a report by Lieut.-Colonel Mount and Mr. J. P. S. Main, M.I. Mech. E., on the failure of connecting-rods on two London and North-Western engines. The first case is that of locomotive No. 877, which broke down at Cheadle Hulme on April 28th. After careful sifting of all the evidence the reporters reach the conclusion that the accident was caused by water in the cylinders assisted by a flaw in the left-hand rod. About one gallon of water in each cylinder would have been sufficient to cause the accident. There is, however, no evidence of priming, and how the water gained access to the cylinders is left unexplained. The engine had run 45,000 miles since its last general overhaul, and was once more ready for the shops, but Colonel Mount expresses the opinion that "there can be no reason to blame anyone individually for allowing the engine to be in work on comparatively light duty." The second case is that of tank engine No. 1710, which failed on May 5th at Furness Vale. Like No. 877, this engine had Joy's valve gear. When running at about 55 miles per hour the left-hand connecting-rod broke through the jack link pin hole, with the result that the boiler barrel was pierced after running 240 yards. The damage was small. The cause is easily attributable to a flaw in the section of the rod through the jack link pin hole. Colonel Mount holds that the flaw should have been noticed. In concluding the report, it is stated that in the first six months of this year fourteen connecting-rod failures on passenger trains had been reported. For the seven pre-war years the average number of failures was thirteen per year on all lines.

## Another Bridge Across the Forth.

THE Stirlingshire County Council has approved a report on a scheme for the construction of a large bridge across the river Forth at Alloa. The estimated cost of the structure is £171,000, and, the Council considers, should be borne by Imperial funds, in view of the national importance of the scheme. Alloa is situated near the head of the Firth, about 18 miles above the present Forth Bridge, and is only some six miles east of Stirling, at which point the river Forth is already crossed by important railway bridges. The proposed new bridge is, however, or so we gather, not intended for railway purposes, but for road transport, and would afford a much needed arterial connection with the Highlands and the North-East of Scotland.

# The Shoe and Leather Fair.

No. 1.

## Introduction.

The preparing of leather and the making of leather goods which at one time were trades solely carried on by craftsmen have become, since the introduction of machinery, highly organised and specialised industries. It was to be expected, therefore, that the annual Shoe and Leather Fair, which was held at the Royal Agricultural Hall, Islington, from Monday to Friday last week, would present features of interest to the engineer. The Fair was the twenty-third of the series, which began in 1895, and for the first time since the war there was a large section devoted to working exhibits of boot and shoe machinery. The last large machinery exhibition was that of the 1913 Fair, and, owing to the closing of the experimental departments of the various machinery manufacturers during the war and the enforced discontinuance of experiment and research on new machines during that period, trade conditions have been such that many new machines were shown for the first time this year. Broadly summarising the lines of development, we may say that the speed of stitching and sewing has been increased, electricity is being increasingly employed for group and independent drives, as well as for searing tools and wax heating appliances, and the use of machinery in repair work has been largely augmented.

In the specialised manufacture of boots and shoes of various types upwards of two hundred operations may be involved, and in almost every case a machine has been designed to perform the operation or assist the skilled operative. Factory methods are under constant review and new machines for increasing the speed and efficiency of manufacture are the subject of continuous test and experiment. These facts do not allow, in a description such as the present one, of dealing in any connected way with the entire range of machinery; but it may be both interesting and useful to select here and there an example of a machine, with a view to showing that the problems to be solved demand a wide knowledge of the principles of machine design and construction, and that such machines require a highly organised and well-equipped engineering works for their successful manufacture. Briefly stated, the series of operations which go to the making of a boot or shoe may be condensed into the following four stages: the preparation and the making of the upper, the preparing of the bottom leather, the assembling of these parts, and the finishing.

The Singer Sewing Machine Company, Limited, showed a wide range of flat sewing machinery with special edge trimming and other attachments. The principal stand of large machinery covering the entire range of the operations above mentioned was that of the British United Shoe Machinery Company, Limited, of Union Works, Leicester, which company exhibited some thirty examples of new machines designed by them for the boot and shoe, harness, and leather case making trades, from which the following examples are taken.

## A Pulling-over Machine.

This machine, illustrated in Fig. 1, performs the first and most important operation in the making of a boot, which consists in pulling the upper over the last and securing it to the inner sole prior to the process of lasting. The actual pulling over of the upper is performed by a series of five pincers, which grip the upper, two at each side and one at the extreme end of the toe. The actuating mechanism is such that the forward pair grips and pulls in advance of the two pairs at the sides, this feature of the machine ensuring an accurate draw of the upper over the last. A further refinement is that the forward pincers are given a receding motion simultaneously with the pull of the side pincers, which enables the four side pincers to deal more effectively with the pulling of the upper into the difficult side curves of the last. The machine is so designed that it can operate equally well on the lightest and most delicate leathers and the strongest and heaviest without tearing them. This flexibility and gentleness of pull is made possible by the controlling mechanism, which embodies an oil dashpot and an arrangement whereby simple adjustments to the oil control valve regulate the strength of pull of the pincers to suit the work being dealt with. The complete cycle of the machine is divided into two parts, the first part being that just described in which the upper is gripped, while in the second part the upper is released from the pincers and secured in position by tacks. A pause is made between the two parts of the cycle, which pause enables the operator to make any adjustment he may require, such as, for instance, trueing up the upper on the last, squaring up the toe cap, or placing the eyelet holes in correct alignment. In the actual machine the arrangement of the mechanism is such that the upper may be manipulated in any way while in the grip of the pincers and under tension. It may be remarked that, in contradistinction to earlier types of machines, the angle of the bed is such that the boot remains in full view of the operative the whole time. The alignment of the upper having been checked, the second portion of the machine cycle is begun. Clamping arms close tightly on to each side of the last and wipers pass over

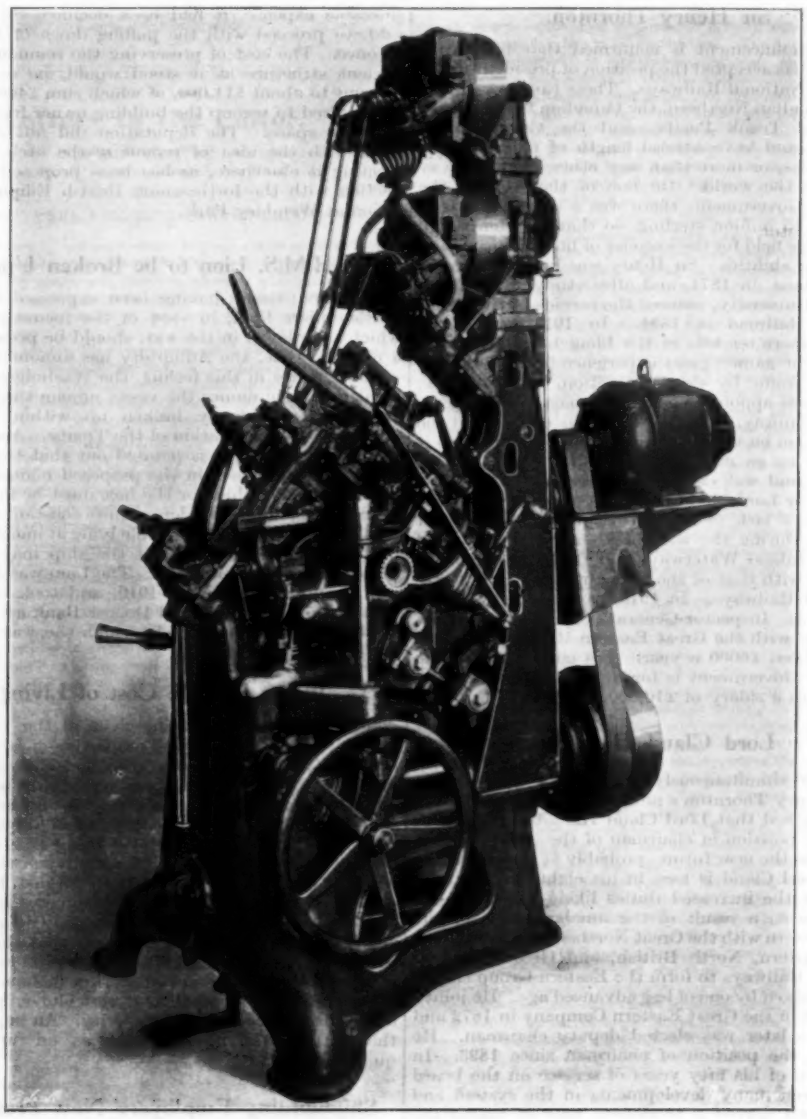


FIG. 1—BOOT UPPER PULLING-OVER MACHINE

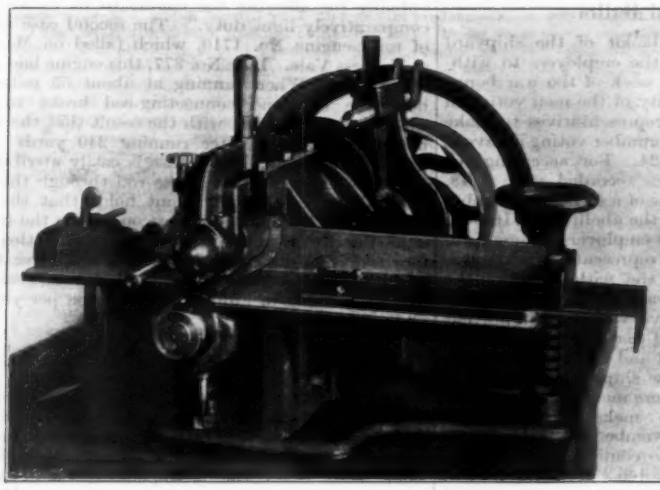


FIG. 2—BELT SPLICING MACHINE

FIG. 3—LEATHER EDGING MACHINE

the edge of the last on to the sole surface. In the wiper arms are pockets carrying tacks, and each is furnished with a tack-driving device. When the wipers pass over the edge of the last the pincers are automatically released and move upwards into a position clear of the wipers, and at the same time seven tacks are driven through the upper and insole into the wooden last. The tacks are fed into races and are selected into groups of seven, after which they are transferred by air blast to the tack carrying pockets in the wipers already mentioned. This operation involves the complete reversal of the tack, which in its final position is head downwards. This reversal is accomplished by passing the tacks through a loop in the air passage. The machine as shown in Fig. 1 is furnished with duplicate tack storing and selecting devices, which provide for two lengths of tacks for different kinds of work; a simple adjustment places either system in operation. It will be noted that the machine is driven by an independent electric motor. Some idea of the intricate and ingenious design may be gained when we say that the machine comprises over 2500 parts.

### A Belt Splicing Machine.

For the making of long driving belts it is necessary to join together the smaller lengths of similar width and thickness which are cut from the hides. These smaller lengths are spliced and cemented together, and in the usual method of splicing the leather is cut lengthwise, an operation which often causes the leather to stretch. In the present machine, shown in Fig. 2, the splitting and forming of the taper splice is done by passing the end of the belt strip sideways on to the knife, which, it is claimed, avoids stretching and cuts a perfect splice. The machine is simple in design and it consists essentially of a table for supporting the work and a pair of rollers which carry the leather forward on to the knife. The upper roller is knurled and serves to impart the feeding motion, whilst the lower has a formed shape corresponding to the length of splice required. The varying thickness of different pieces of leather is compensated for by a special device which tilts with the knife, and a feature of the work turned out is that both ends of the splice are accurately defined by mechanical action. There are two models of this machine, which jointly deal with splices varying in length from 3in. to 8½in. The length of splice is controlled by the shape of the bottom roller, various sizes of which are supplied with the machine. Belts of any width may be cut.

### An Edge Trimmer.

In order to finish neatly the edge of the thin leather forming the upper of a boot or a shoe, it was, until quite recently, a usual process to skive the edge for about $^{3}/_{16}$in., fold over this edge and cement it down all of these operations being performed by machinery. The machine, reproduced in the engraving Fig. 3, accomplishes this same end by a new method, which, it is claimed, is neater, stronger and cheaper than folding. The essential parts of it comprise an electrically heated tool, a combined edge gauge and edge turning device, and a hammering mechanism. The edge to be operated upon is first passed through a skiving machine, which removes a very narrow strip of material, after which it is ready for the edging machine. The heated tool of the edging machine sears the flesh just inside the edge and melts the gelatinous substance next to the grain, causing the edge to turn up, which action is assisted by the edge gauge. Immediately behind the searing tool, which is heated to redness by a heavy low-voltage current, is the hammer, which completes the operation of turning in the edge of the grain about $^{1}/_{32}$in. while it is still in a plastic state. The finished appearance of the work seems excellent and permanent in character, and the edge lies very close when placed over similar material for the purpose of forming a seam. The new process saves material, it simplifies the operation of skiving, and the edge, according to the manufacturers, is not weakened as in the case of folding. The rheostat which controls the heating of the tool is regulated by foot independently of the feeding mechanism, which enables the operator to control the work with both hands and regulate the heat of the tool in proportion to the feed when turning corners.

### A Sole Leveller and Other Machines.

We reproduce in Fig. 4 a view of a new sole levelling machine of the direct pressure type for levelling welted boots on the last. The moulding of the surface of the leather sole smoothly to the shape of the last, is effected by mounting the lasted boot on a rigid jack with its sole uppermost, and subjecting it to heavy pressure, which is applied through a spring-pressed beam furnished with moulds bearing the exact contour of sole desired. In the actual operation the jack carrying the boot is given a slight rolling motion over the face of the mould, which gives line contact over all parts of the sole. This rolling motion enables a heavy pressure to be put on the sole, but at the same time it permits of limits of pressure being employed which are safe for both the last and the upper. The illustration shows the series of heavy link motions which produce the rolling pressure, and these are operated by means of worm gearing. The jacks are fitted with an automatic regulating device which compensates for varying thicknesses of soles. The machine is characterised by its robust and compact design, and it is driven by an independent motor attached to it. Other machines which space does not permit us to describe in detail were the special stitcher for stitching the square corners of leather cases, and an improved form of grading and evening machine, in which the measuring mechanism is separated from the splitting mechanism, enabling the machine to record the thickness of a fresh piece of leather while the splitting mechanism is finishing the operation on the previous piece. In an earlier form of this machine it was necessary to wait for the machine to perform the two complete operations before a fresh piece of leather was introduced. The grading and evening machine selects the thinnest substance on a given area and splits the whole area down to that thickness, stamping the exact thickness dimension on the surface of the leather. It will grade leather up to one ninety-sixth part of an inch.

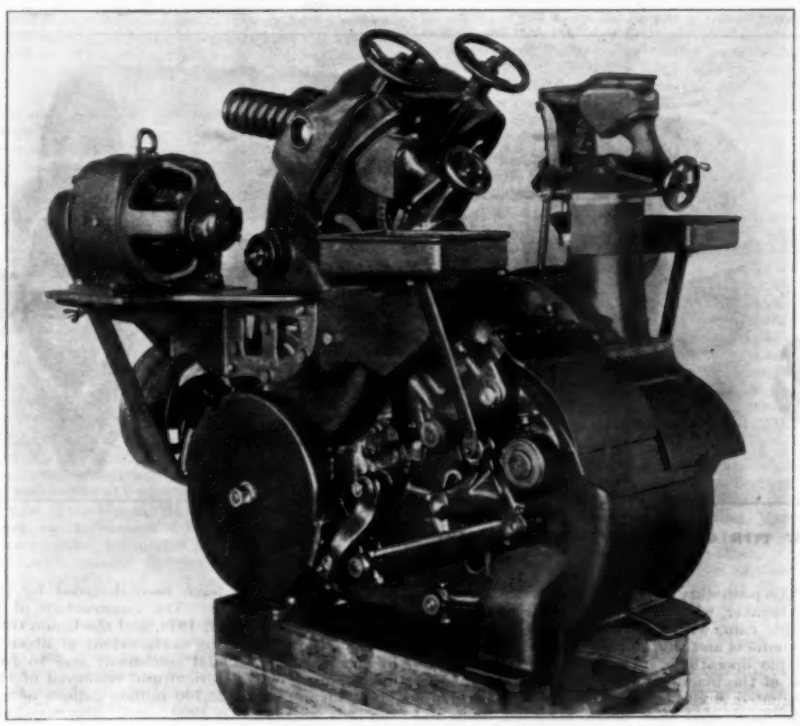


FIG. 4—SOLE LEVELLING MACHINE

### The "Atlas de Luxe" Cemented System.

After speaking of some of the machinery used in the making of boots and shoes by the accepted methods in which the sole is attached by stitching or riveting, we now turn to the "Atlas de Luxe" system of leather welding, in which the sole and upper are united by means of a patented chemical substance which, the makers say, partakes of the character of liquid leather, entering the cells of the leather and becoming part of it and joining the parts to be united into one solid whole. We are familiar with metal welding in the engineering industry and with the use of glue in the preparation and manufacture of wood products, and there would seem to be no serious barrier to the use of an agglutinant for the joining of leather; but whether this method will form a radical and important departure from accepted practice it is as yet too early to say. The English and colonial agents for the Atlas system, Joseph Goldstein, 35, The Minories, E.C., inform us that it is in successful use in continental countries and is being applied to certain types of boot and shoe work in Leicester and Norwich. The sole to be attached is well roughed and sparingly spread over with the special adhesive, after which it is laid aside to dry and allow the adhesive to penetrate into the leather fibres. The method of tanning the leather influences the time allowed for drying, and whereas for bark-tanned leather the penetration may be effected in about an hour, several hours are required for chrome-tanned leather, on account of the fatty matter left in the skin; the action may be stimulated in such cases by a previous treatment with a special acetone solvent. The two parts to be joined having been thus prepared, they are rendered tacky by painting over with the "Atlas de Luxe" solvent previously mentioned and are then submitted to pressure for a given time. Again, the difference in tanning asserts itself, and for bark-tanned leather pressure is maintained for thirty to forty-five minutes, and for chrome-tanned leather a period up to four hours is recommended. After pressing, the leather is laid aside to dry. Complete drying in the case of bark-tanned leather takes place in two hours, while cemented chrome-tanned leather takes a much longer time, sometimes as much as twenty hours being required. After complete drying has taken place it is stated that the combination is so intimate that it is not possible to separate the piece and the joint is not affected by moisture or heat or cold. A special press is used for giving the required pressure, which we illustrate in Fig. 5. The pressure is put on by means of a small hand-operated windlass seen on the right of the machine. Special air-inflated forms are used to secure even pressure over the whole surface to be united, and these forms are fitted with perforated

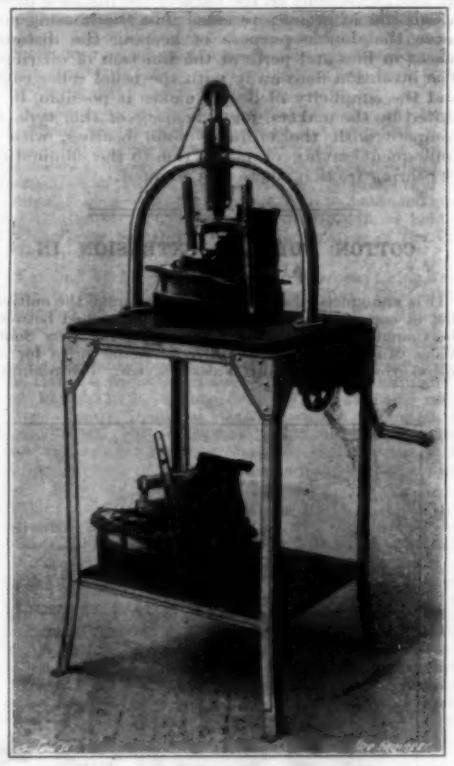


FIG. 5—THE "ATLAS DE LUXE" PRESS AND FORMS

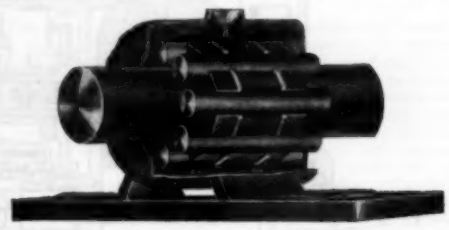


FIG. 6—A NEW FORM OF ROLLER BEARING

stirrups, which provide a means of securing the cross piece so that the whole form can be removed from the press after the cross piece has been clamped in the pressure position. This system may be used both for manufacturing and repairing.

A New Roller Bearing.

An interesting form of patented roller bearing was shown by the Northampton Machinery Company, Limited, of Northampton, which also demonstrated a number of auxiliary machines. The bearing, which we illustrate in Fig. 6, briefly described, consists of a simplified form of housing in which is inserted a series of plain ground rollers, which are kept in position by intermediate distance pieces placed between each roller. These distance pieces are kept in alignment by two projections on the back of the distance piece, which run in grooves recessed into the housing and serve the double purpose of keeping the distance pieces in line and perform the function of oil rings. The invention does away with the usual roller cage, and the simplicity of design makes it possible, it is stated by the makers, for a bearing of this type to compete with the ordinary solid bearing, with a consequent saving of power due to the elimination of bearing friction where it is adopted.

## COTTON CULTURE EXTENSION IN AUSTRALASIA.

It is announced that in order to encourage the cultivation of cotton, an agreement has been reached between the Commonwealth Prime Minister and the New South Wales Ministry, guaranteeing a minimum price for all cotton grown in New South Wales this year. The minimum price will be the same as that obtaining in Queensland, namely, 5½d. per lb. The Federal authorities will contribute one-third, the New South Wales Government a similar proportion, and it is hoped the Imperial Cotton Association will find the remaining third, failing which the two Governments will make up the balance.

The managing director of the Australian Cotton-growing Association, Limited, Mr. Crawford Vaughan, has announced after a tour through Queensland and the Northern Rivers districts of New South Wales, that the Association this year anticipates an expenditure of £250,000 in additional plant, not including a spinning mill to be erected later. Applications for seed in Queensland have been made for 85,000 acres. The bulk of the plantations are in small areas of from 20 acres upwards, though as many as 300 acres will be sown by individual settlers. One authority estimates that the value of the Queensland crop this season will reach £100,000. The *Pastoral Review* (Melbourne) learns that a syndicate at Rockhampton, North Queensland, has purchased 750 acres of land 10 miles from Rockhampton, with a view to putting the area under cotton. A practical farmer, Mr. C. H. Downs, has been appointed manager.

The Queensland cotton expert, Mr. Daniel Jones, who was asked by the Western Australian Ministry to report on what regions in that State were most favourable to the growth of long-staple cotton, has taken a favourable view of the prospects, and considers that, with watering, cotton can be grown along the route of the railway line from Perth to Kalgoorlie. He is also of opinion that the north-west portions of the State should yield cotton as well as Queensland.

A Sydney company has intimated its intention of establishing a cotton-spinning industry at Waterloo, a suburb of Sydney. It is understood that provision will be made for the employment of approximately 1000 hands, and that the whole of the machinery will be electrically driven.

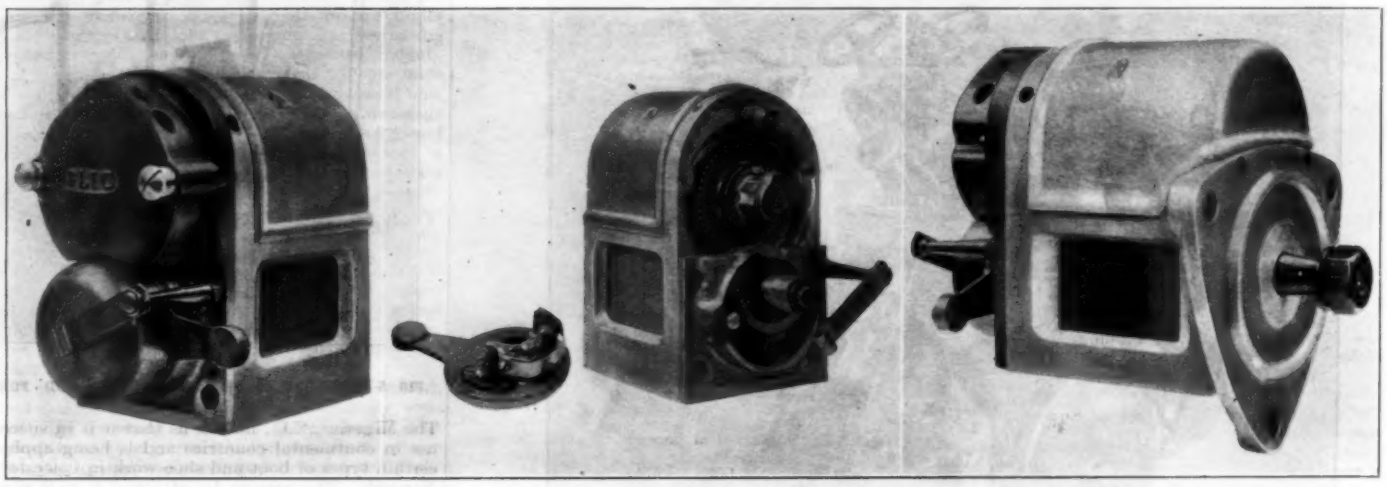
## A New Magneto.

At the invitation of the British Lighting and Ignition Company, of Cheston-road, Aston, Birmingham, we were recently afforded an opportunity of inspecting a new magneto which has been designed with a view to reducing weight and cost. The machine, which is shown in Figs. 1 to 3, differs from an ordinary magneto in that the armature is stationary, whilst the field magnet, which is very much smaller than usual, revolves. The stationary armature enables the machine to be insulated in a very thorough manner, for rotating armature connections, &c., have been completely eliminated, as have also the usual slip rings, brush holders, &c.

In place of these arrangements, a short stationary connector piece is used for leading the high-tension current from the stationary armature to the stationary distributor terminal. The possibility of breakdown is thus remote. The contact breaker, which is also stationary, is actuated by a revolving cam, with the result that the job of re-setting the contacts and that of cleaning, &c., are reduced to very simple operations. The materials used in the construction of the magneto, such as permanent magnet steel, impregnated silk ebonite, platinium, &c., are subjected to the most rigid tests before they are used, and the employment of a small revolving magnet in place of the usual large stationary magnet, has been made possible by the use of cobalt steel. The magnet and the cam are the only revolving parts, and the contacts are not affected by wear to the same extent as those associated with the ordinary type of magneto.

From the sectional views of the machine given in Fig. 4, it will be perceived that the stationary armature, which consists of a laminated core, upon which primary and secondary coils are wound, is fixed above the revolving field.

Single-cylinder machines are built on a slightly smaller scale than the car models, although as regards fixing dimensions they are strictly interchangeable with existing standards. The new machines are much lighter and more compact than older types of magnetos, the M1-R machine, for example, weighing only 3 lb. The high-tension armature connection makes direct contact with the base of the high-tension plug lead terminal, and these are the only heavily insulated parts in the machine. Special fan-shaped pole shoes are employed. In order to remove the contact breaker for examination, only the cover retaining spring need be displaced, when cap and contact breaker may both be withdrawn. The heel piece, lever arm and pivot bush, together with a miniature grease reservoir for lubricating the pivot, are formed in a single element, consisting of bakelite-dilecto laminæ, an arrangement which eliminates the sticking contact lever with which many motorists are familiar. All types of the new magneto are water-tight and dustproof. Before these magnetos are despatched from the works, they are tested at abnormally high and low speeds, and machines that do not give perfect sparking over a much greater range of speed than is called for in practice are rejected, the idea being to ensure easy starting, slow running and maximum power when running at high speeds. The entire magnetic structure is effectively laminated, and notwithstanding the exceptionally low weight of the machine, excellent sparking is secured.



FIGS. 1, 2, AND 3—NEW TYPE OF MAGNETO, WITH STATIONARY ARMATURE

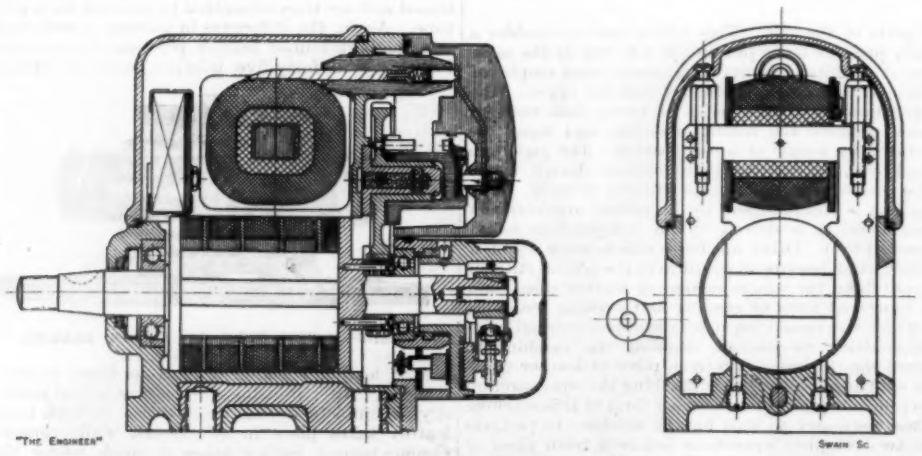



FIG. 4—LONGITUDINAL AND CROSS SECTIONS OF MAGNETO WITH STATIONARY ARMATURE

## COMPLETION OF A SOUTH AFRICAN IRRIGATION WORKS.

The Lake Mentz Water Conservation works, which command the Sundays River valley near Port Elizabeth, have recently been completed. The works, which are built along the lower reaches of the Sundays River, are the largest of their kind in South Africa, being second only in size and importance in the whole of Africa to the Assouan Dam, and have been designed by the Union Irrigation Department. The construction of the work commenced in January, 1918, and the Union Government financed the undertaking to the extent of about £560,000 in the interests of land settlement and to further the development of the agricultural resources of the Union. The dam impounds 25,700 million gallons of water, and the area submerged is 4900 acres. The maximum height of the dam from its foundation is 150ft. and the height of the structure above the river bed level is 95ft. Its maximum thickness at the bottom is 80ft., and at the top 8ft., while at the top its length is 1150ft. There are five flood gates each 30ft. by 25ft., and the total content of the concrete dam is 150,000 cubic yards.

Additional subsidiary works lower down the Sundays River in the area commanded by Lake Mentz have been constructed by private enterprise at a cost of some £600,000. They consist of three diversion weirs, main canals extending for 73 miles and subsidiary canals of a total length of over 400 miles. This big scheme aims at intensive cultivation under a permanent water supply of an area of upwards of 40,000 acres in the Sundays River valley. This district, under previous conditions, with an intermittent water supply, already attracted numerous local overseas settlers of the best class, and its further development under new conditions of an assured and sufficient water supply should be rapid.

After the annual inspection of the Edinburgh electricity works recently, Mr. Bruce Lindsay, convener of the Electricity Committee, entertained the members of the Committee, officials, and others to dinner in the Caledonian Station Hotel. In the course of a statement as to the progress of the Portobello power station, Mr. Lindsay said that the three 10,000-kilowatt turbo-alternators, with their condensers, air pumps, and auxiliary plant, were complete, with the exception of a small amount of pipe work. Two of the boilers were practically finished, and a third boiler would probably be ready by the end of November. The other three boilers were not so far advanced, but the first three would be sufficient to meet this winter's demand. The idea had been put forward of having an open-air bathing pond at Portobello, which would be supplied by the warm water which had passed through the condensers. The temperature of the water as it left the condensers would be something like 80 deg. Fah. He hoped they might be able to carry through such a scheme.

## Railway Matters.

The report of Colonel Pringle on the railway accidents of 1921—Cmd. 1755, price sixpence—was issued on the 6th instant. We hope to comment upon it in a subsequent issue.

A collision between a passenger train and a light engine occurred on Saturday, the 7th instant, outside the St. Enoch's Station, Glasgow, of the Glasgow and South-Western Railway.

The roof of St. James's Park Station, Metropolitan-District Railway, is now being taken down so that a five-storey building may be erected over the station to provide offices for the Underground system.

We are advised by Mr. G. T. Glover, of the Great Northern Railway (Ireland) that what he said at the Rome International Railway Congress was that the failures of the electric lighting in that company's carriages, which included dull lights, often averaged one failure only in 90,000 miles.

According to a letter from the Railway Clearing House to the Association of British Chambers of Commerce, reductions are to be made, as from the 16th instant, for wharfage, cargo dues and rent charges for ships lying up at railway-owned docks where such charges are in excess of 100 per cent. above those operative in 1913.

We congratulate Sir Henry Thornton, the general manager of the Great Eastern Railway, on his appointment as president and chairman of the board of management of the Canadian National Railways, and we congratulate the Canadian Government on its selection. His removal to Canada robs British railways of one of its few engineer-trained general managers.

The Eastern Group of railway companies has issued a booklet with the object of encouraging the establishment of additional industries in the districts it serves. The seven constituent companies work 7000 miles of railway, own 294,000 wagons (carrying in a normal year 183,000,000 tons of goods and minerals), 38 docks, 33 miles of quays, and 210 coal shipping berths, and they have four passenger termini in London.

It comes as no surprise, seeing that he is nearly eighty years of age, to hear that Lord Claud Hamilton has intimated his intention to retire, in view of the inclusion of the Great Eastern Railway in the Eastern, North-Eastern and East Scottish Group. Seeing that six boards of directors are to be replaced by one board of twenty-eight directors, there will be a large field for selection, and it is not likely that any but the younger and more active men will be chosen.

The Inner Circle trains now consist of five, instead of four, cars. The Baker-street and Waterloo trains, during the rush hours, consist of six cars instead of five. On the Great Northern, Piccadilly and Brompton the headway of trains is now 3 minutes in place of 2½ minutes, and on the Central London there is a continuous service every 2 minutes. On the Golder's Green and Highgate sections of the Charing Cross, Euston and Hampstead there are thirty-eight trains per hour.

At the Institution of Railway Signal Engineers on the 4th instant Mr. T. S. Lascelles read a very interesting paper on the system of signalling now standard in Belgium, which was devised by the late Mr. Weissenbruch, the chief signal engineer of the Belgian State Railways. The reading of the paper was accompanied by numerous illustrations on the lantern screen, by models and photographs. There was little time available for the discussion, which was therefore postponed to the next meeting on Wednesday, November 1st.

So successful have been the experiments with four petrol motor-driven trains on the suburban service that the Chicago Great Western Railroad is preparing to expand this branch of its equipment to fifteen such trains, which will be used mainly in the thickly populated districts of Iowa. The trains consist of a specially constructed motor car, equipped with a high-power petrol engine and a trailer which resembles an ordinary inter-urban electric coach, although more heavily built. The motor car has room for goods and baggage at the back of the compartment occupied by the engineer. The four trains now in use in Iowa are making runs of from 100 to 150 miles a day.

France, Great Britain, Italy, Belgium, Holland and Sweden were represented at a meeting of the Committee of Railway Transport of the International Chamber of Commerce, held in Paris on Monday last, when Baron d'Erlanger, supported by M. Bertin, urged the construction of a Channel tunnel, the cost of which would not exceed £20,000,000. M. Bodin, Vice-president of the Calais Chamber of Commerce, and Mr. Bodington pointed out that the construction of the tunnel would take at least twelve years, and he proposed the creation of an interim ferry service which would require only a small capital. Three steamers were, he pointed out, now available for such a service. The Committee passed a unanimous resolution in favour both of a ferry service providing it were of a remunerative character, and of the tunnel, which seemed to be the best method of organising a fast and effective service.

A class of railway accident against which no mechanical provision can be made is that caused by trains running into bales, bundles, &c., that have fallen from trains and created an obstruction. On the night of the 5th instant a bale of cotton fell off a goods train on the Midland main line between Settle and Carlisle. A goods train ran into the obstruction, leading to a derailment fouling the other line, and before an alarm could be raised a goods train in the opposite direction ran into the *débris*. Both lines were consequently obstructed and traffic had to be diverted over the London and North-Western. Such diverted trains run over the latter company's main line between Carlisle and Low Gill and then over that company's branch to Ingleton. The Midland has a branch from Ingleton to Clapham (Yorks.), which, at the latter place, joins the line from Morecambe and Carnforth to Settle. It was by this route that the Midland reached Carlisle before the Settle and Carlisle was opened on May 1st, 1876.

## Notes and Memoranda.

The application of the geophone to mining operations is described in a technical paper recently issued by the United States Bureau of Mines. The development of the instrument by the French during the war is referred to, and some experiments carried out in America are detailed. It was found, for instance, that the sound of hammering on a railway line with a 14 lb. sledge could be heard no further along the line itself than it could be through the rock. The actual distance was about 400ft. The instrument was found to be effective in determining the position of mine fires, bore-holes which were being drilled, and clay veins in metal mines.

In a letter addressed to *Nature* of September 16th, Mr. E. T. Paris, of the Signals Experimental Establishment, Woolwich, suggests the use of a hot wire grid, as used in the Tucker microphone, for the purpose of constructing a standard source of sound. The grid would be fixed at one end of a Helmholtz resonator, and a telephone at the other end; the telephone would be actuated with current from a thermionic valve oscillator, at a frequency equal to that of the resonator, giving a pure tone of moderate intensity, and the change of resistance suffered by the microphone grid would afford a measure of the amplitude of vibration of the air column, and therefore of the strength of the source, which could be varied at will. If the frequency of vibration were known, the strength of the source could be found in absolute measure.

Some interesting information regarding the mechanical properties of the modern storage battery is given in an article by Messrs. L. C. Ilsley and H. B. Brunot in a recent issue of the *Electrical World*. Certain tests made by the U.S. Bureau of Mines had shown that the safe operation of the battery locomotive would largely depend on the proper care of the battery and on the employment of a battery which should be as mechanically rugged as possible. Four standard makes of battery were tested for ruggedness, the tests consisting in jarring the cells 100,000 times by dropping them vertically on a timber framework from a height of about 2in. forty to sixty times per minute. In most cases the cells were charged and discharged during the greater part of the test. Readings on both charge and discharge after this process was accomplished indicated that no perceptible injury was done to the cells.

Since the electrification of the Swiss Federal Railways was partially carried through, the heating of the carriages has been effected by electric radiators, except in international trains, in which steam heating, as previously used, has been adhered to temporarily. As a result of this some source of steam has to be provided on the train itself, and this has been done by installing an electrically heated boiler specially adapted to the requirements of the railways. For purposes of economy it was decided to use the current of the overhead line, the pressure of which is 1500 volts, without transforming it, but this gave rise to insulation difficulties. Further, it was found desirable to install the boiler on a special coach, capable of being coupled to any desired point on the train, in order to obtain uniform heating. The boiler absorbs 800 kilowatts and supplies steam at a pressure of about 113 lb. per square inch.

The failure of paint and varnish on exposure to the weather is engaging the attention of experts of the United States Bureau of Standards. During the recent meeting of the American Society for Testing Materials there was discussion of the mechanism of failure of paint and varnish films on exposure to the weather. One party to the discussion claimed that a paint or varnish film should contain moisture in order to retain its elasticity. The known beneficial effect of baking a varnish film was then cited as being contradictory to this theory that moisture improved the durability of paint or varnish. The importance of the problem makes it appear advisable to study baked varnish films in order to obtain some definite data on the effect of baking. The Bureau has commenced an investigation, in which a series of spar varnishes of varying contents of oils will be baked on tin panels at different temperatures, and then tested for durability when exposed to the weather.

At the Dunswart Iron and Steel Works, South Africa, which is equipped with a 7-ton Heroult electric furnace, current is obtained from a sub-station of the Victoria Falls Power Company at 6600 volts pressure. This is stepped down to 2200 volts, and again to 85 volts for use in the furnace, where it is conducted through three 9in. graphite electrodes, the current being automatically controlled by a Thiery regulator up to 8000 ampères. The ingots made are 7½in. at the top, 3ft. 6in. long, and 6½in. at the bottom, and weigh 600 lb. It is intended later on to manufacture steel castings up to 7 tons in weight and the works are designed for this purpose. Under normal conditions these works will have an output of 500 to 600 tons per month. A new three-roll high 18in. cogging mill is in course of erection, capable of turning out 6in. squares, 6in. angles, 10in. flats, 6in. rounds, and other sections as required. It will be driven by a 600 horse-power motor running at 360 revolutions per minute and driving the mill at 150 revolutions per minute by means of ropes.

Some months ago it was reported that a deposit of hematite ore was being exploited by a Japanese company on Bukit Menia, near the Batu Pahat River, in Johore. It is now stated officially that a deposit of ilmenite (titanic iron ore) has been discovered in Ulu Sedili, in Johore, and that iron ore of one kind or another exists over an extensive area in that State. A Japanese company holding a prospecting licence for coal near Khuang has reported its failure to discover any coal; but inquiries have been received by the Johore Government regarding a deposit of unusually pure sand at Batu Pahat, which, it is thought, may be suitable for glass-making. With reference to the position of a large hematite deposit at the north end of Gunong Panjang, close to the high road from Ipoh to Tambun, in the State of Perak, local newspapers state that *personnel* and transport are at present unavailable for the immediate working of the ore. This deposit is said to contain upwards of 5,000,000 or 6,000,000 tons within 100ft. of the surface. A Singapore foundry has agreed to buy any quantity of the mineral.

## Miscellanea.

A capital of 10,000,000 dollars (nominally £2,000,000) has been subscribed by an influential American financial corporation for the purpose of hydro-electric enterprises in Italy, principally to supply the provincial districts in the northern part of the kingdom.

An extensive scheme is in contemplation for supplying electricity to Burma. It is proposed to divert the waters of the Yunzalin River, and to send it down a slope and through tunnels, thereby supplying the motive power for the generation of electricity for transmission to Rangoon.

Arrangements are now being completed for the manufacture of cement on a large scale at Berriedale, about 6 miles from Hobart, Tasmania. It is anticipated that the first unit of the plant will be completed and the manufacture of cement begun in about nine months' time. It is hoped to turn out 30,000 tons a year and to give employment to about 150 men. The concern has been styled the Tasmanian Cement Company.

We are informed that his Royal Highness the Prince of Wales has graciously accepted an invitation to be present at a joint dinner of the Institution of Mining Engineers (representing coal-mining engineering) and the Institution of Mining and Metallurgy (representing the mining of minerals other than coal), to be held on Thursday, November 16th next. The dinner will be held at Guildhall, by permission of the Corporation of the City of London.

The imports of copper ingots into Hankow, China, from America between January 1st and May 19th, 1922, amounted to approximately 12,847,000 lb.; Japanese copper ingots, 4,706,000 lb.; and other foreign ingots, through Shanghai, 1,177,000 lb. According to the returns of the Maritime Customs, the imports of copper ingots into Hankow from Japan were 14,659,067 lb. during 1920 and 10,950,133 lb. during 1921. American and other copper ingots imported into Hankow amounted to 5,747,733 lb. in 1920, and 14,441,333 lb. in 1921. In recent years Hankow has replaced Shanghai as the centre of the copper market for Central China. This copper is used almost entirely for minting purposes.

Plans have just been completed for a new technical institution in Calcutta, to be erected on the south side of Corporation-street in the vicinity of Mott-lane. Although it is not at present intended to carry out the scheme in its entirety, the building, when completed, will provide accommodation for about a thousand students. It has been estimated that the total cost of the completed building, which will be three storeys high, will reach Rs. 3 lakhs. The new structure will, when completed, contain four large lecture theatres, a large machinery hall, a library, numerous classrooms, a laboratory, provision for the teaching of drawing, and also a number of workshops. Both day and evening classes will be conducted.

According to a message from Turin, the contract for the construction of the first group of works in connection with the extension of the port of Spezia has been awarded to the firm of Vitali, of Rome, for a sum of 10,434,900 lire. The firm has undertaken to finish the work within thirty-two months. The financing of the enterprise has been entrusted to a Rome bank, which has already placed 12 million lire at the disposal of the port board for this purpose. The Italian Syndicate for Marine Installations, which was formed two years ago with a capital of 30 million lire, and which is carrying out new works at the port of Venice, is studying a plan for the enlargement of the port of Leghorn, over an area of 1,200,000 square metres. The cost is estimated at 83 million lire.

Important electrical power developments in the Pas-de-Calais district of Northern France are announced. As a result of the success which has attended the utilisation of cheap and unmarketable fuel for developing power at the various central electric stations, established at the coal mines, such power being transmitted at high voltage to other parts of France, it has now been decided that the department of the Somme shall be electrified from this source, from the smallest village to the largest town, and notably the city of Abbeville. From the Pas-de-Calais station, one single line of 90,000 volts will run from Boulogne-sur-Mer to Abbeville; while another, passing by Arras (Pas-de-Calais), Amiens and Abbeville (Somme), will carry 45,000 volts. The current will be transformed down to 15,000 volts at Amiens and Abbeville for distribution to the rural districts.

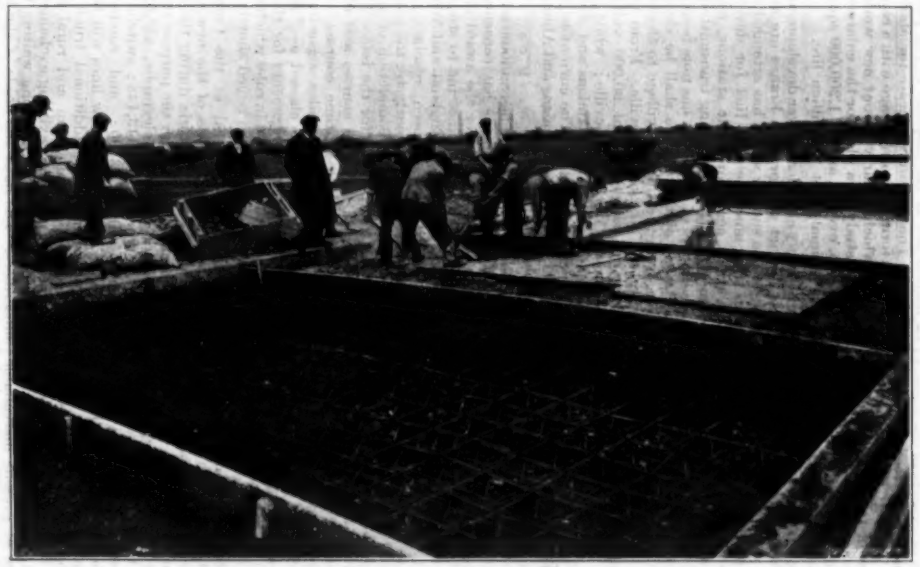
The Board of Education has announced that the Institution of Electrical Engineers has consented to co-operate with it in arrangements for the award of certificates and diplomas in electrical engineering to students in technica schools and colleges in England and Wales. Under the agreement which has been reached, certificates and diplomas will be issued jointly by the Institution and the Board on the successful completion of approved courses. The scheme will provide for the issue of "diplomas" in connection with full-time courses and of "certificates" in connection with part-time courses. Certificates and diplomas will be of two grades, according as the courses to which they relate are classed as "senior" or "advanced." Detailed arrangements for the administration of the scheme will be shown in rules which are now in course of preparation, and will be issued shortly.

The Postmaster-General of the Commonwealth has made available particulars of the new works which are to be undertaken in Victoria during the current financial year, the sum allocated for the purpose totalling £861,000. This amount includes telegraphs, £59,523; telephones, £181,480; trunk lines, £113,148; switchboards, £229,206; pneumatic tubes, £3500; and conduits and cables, £274,143. A number of new lines will be constructed in country districts, and additional trunk telephone lines provided in both suburban and rural areas, while the equipment of numerous existing exchanges will be largely extended to cope with the long waiting list of intending subscribers. The meet the needs of the latter, two automatic exchanges are to be constructed in Melbourne, costing in all £108,000. Extensive conduit and cable work in the metropolitan area is also provided for in the estimates.

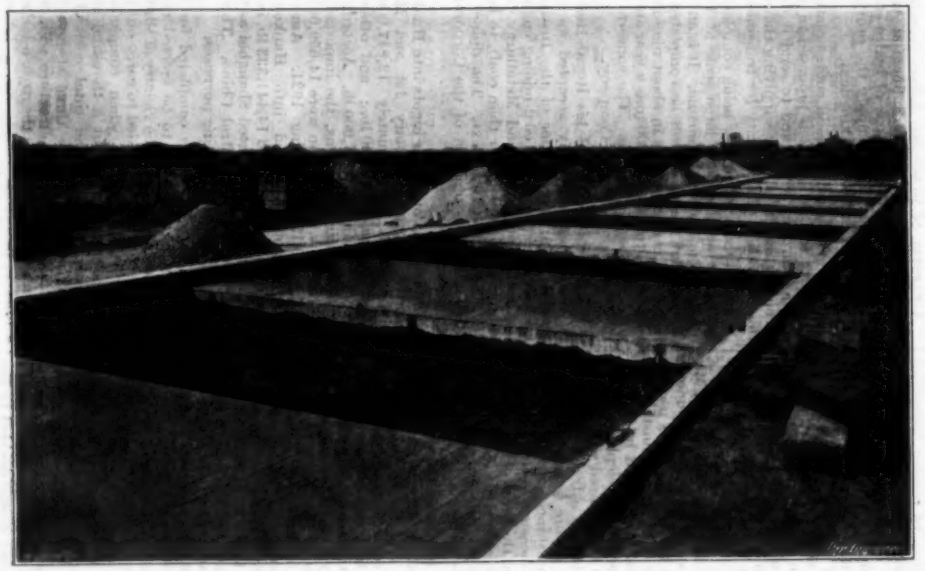
# CONSTRUCTING CONCRETE ROADS NEAR MANCHESTER

MR. J. B. L. MEEK, M. INST. C.E., MANCHESTER, ENGINEER

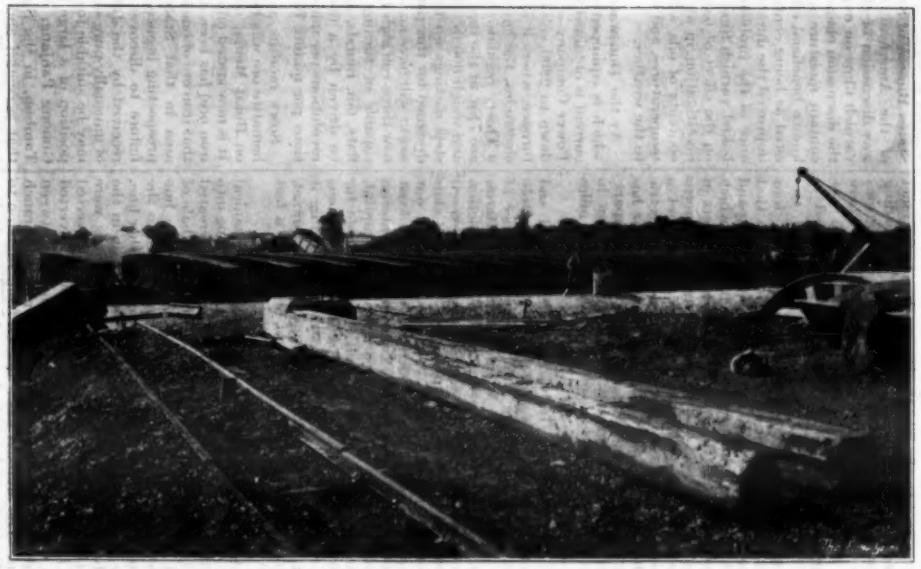
(*For description see page* 375)



RE-INFORCED SECTION OF ROAD UNDER CONSTRUCTION



VIEW SHOWING METHOD OF CONSTRUCTION IN ALTERNATE BAYS



GIRDERS FOR CARRYING THE ROAD OVER THE MIDLAND RAILWAY

BRIDGE CARRYING THE ROAD OVER THE MIDLAND RAILWAY

**AGENTS ABROAD FOR THE SALE OF**

## The Engineer

BUENOS AIRES.—Mitchell's Book Store, 576, Cangallo.
CHINA.—Kelly and Walsh, Limited, Shanghai and Hong Kong.
EGYPT.—Cairo Express Agency, near Shepheard's Hotel, Cairo.
FRANCE.—Boyveau and Chevillet, Rue de la Banque, Paris. Chapelot and Cie., 136, Bld. St. Germain, Paris.
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# THE ENGINEER.

*OCTOBER* 13, 1922.

### The Far East.

If any English engineer will take the trouble to turn to a report on the commercial, industrial and financial position in Japan in the year ending June 30th, 1921, recently issued by the Department of Overseas Trade, he will be struck by two facts of much consequence to himself. In the first place, he will perceive that whilst in the years immediately preceding the war the United Kingdom supplied Japan with 40 per cent. of her requirements in iron and steel, in the year 1920 the proportion had fallen to 23 per cent. On the other hand, America in the same year increased her 15 per cent. to no less than 75 per cent. of the total requirements of Japan in iron and steel in the same year. That is a striking and uncomfortable contrast which cannot be lightly explained away, for it is confirmed by other figures for the total commerce of Japan with foreign countries. Before the war the United Kingdom enjoyed 31 per cent. of that trade and in 1920 that figure had not altered, but the United States, which used to stand second with 22 per cent., had advanced to the first place with 33 per cent. This increasing influence of America in the trade of Japan is the first fact that will strike the reader. The second is that at the time this report was written the influence of Germany was so small that it receives no attention at all—there is no mention whatever of the efforts of the Germans to re-establish their trade with Japan. At first sight, this might appear to be a matter for congratulation; but it is, indeed, just the opposite. Germany is now energetically at work in the Far East, with the result that we have not one active competitor to face, but two. In China the same competition has to be met. The position of the United Kingdom is no longer unchallengable. The United States and Germany are making every effort to undermine it, and nothing but a campaign carried on with all the energy we can command will prevent the repetition in China of the condition exhibited by the figures for Japan which we have quoted above.

In looking for the causes of a state of affairs which gives rise to uneasiness, there is one which seems to us to stand out in greater prominence than the others. It is the ignorance of the East which is found generally amongst English manufacturers. For every engineer that goes East, we do not hesitate to say that a hundred go Westward to the New World. Europe is known to them; Australia, Canada, New Zealand and America; but the East is almost a closed book. Few visit China, Japan and India, and the ways of that world are as little familar to them as its language. The old ideas persist. The Englishman still fails to think of the East as a matter-of-fact region where matter-of-fact business has to be done. He sees the poetical, the picturesque, the romantic and the antique side of the lands East of Suez, but not their practical side. He possibly believes that England still holds the gorgeous East in fee, and he fails to balance the increasing influence of other nations. It is, we are convinced, necessary that this condition should be changed. China and Japan are too far distant to permit of the frequent visits that are readily paid to the Americas, but unless a personal contact is maintained with them we shall not succeed in facing the competition of Germany and the United States. It is not only that to learn the East one must live there, but that the personal element enters as largely into business transactions in that part of the world as it does in Europe. We do not hesitate to say that big business is never done without the personal touch. Differences of opinion have long existed as to the relative merits of agents and private representatives, and will continue, but there is an increasing conviction that whilst ordinary "counter" business may be left in the hands of commercial representatives, the presence of a fully qualified engineer is essential when great contracts have to be fought for. The plenipotentiaries of America and Germany in China are men trained in the technicalities of their work, men who can help and guide the Chinese purchaser and who can advise him when he is in difficulties. We hear, moreover, that these representatives are men of address and charm of manner whose personality opens to them doors closed to less-gifted men. If Germany and America are using machinery of this kind, we must use it also, whatever it may cost. Two years ago we wrote in an article that received the hearty approval of those who know China: "Above all, more representatives are needed—not men whose interest in locomotives and signals is only partial, but men who have made an intimate study of those subjects. It may cost a firm three thousand a year to keep such a man in China, but the choice lies between engaging him and seeing fine orders for material go to America." And again: "Let not the British manufacturer . . . imagine that orders for railway material in China will flow in without trouble. He has to meet there very active, very intelligent, very astute competition, and the only way to do so is to provide himself with the very best representative men he can secure." What is true of China is even more true of Japan. The Japanese, highly trained engineers themselves, prefer to meet the trained engineers of this country. Purely business men will not "fill the bill"; the representative must be a man who can see and appreciate technical requirements, and can answer fully the expert questions that are put to him. We commend to the attention of our readers a letter from a recent visitor to Japan which appears in our correspondence column to-day. How Germany is "sapping her way back into her old position" in that country by the employment of representatives who combine *savoir faire* with technical experience should be carefully noted.

We are endeavouring by the appointment of representatives in China to offer our readers something of the Eastern atmosphere, whilst, at the same time, we seek to indicate to them the directions in which they may look for the development of markets, but we are under no illusion that we can do more than open up new views before them. Further progress rests with them themselves. We know only too well the financial straits to which many months of depression have brought British engineers, but, recognising as we do the vast field for the engineering trades which is opening in China, we urge each one of them that can face the expense to send out to the East the best man that can be found. Let him be a man with technical knowledge, with a clear brain, with a generous education and strong personality. Give him sufficient authority to conduct business without frequent references to the head office, and we do not doubt that sooner or later the expenditure of a few thousand pounds will be more than justified. On the opposite hand, if British firms neglect this policy, if they leave it to America and Germany to be represented in China and Japan by the best men, if those countries become habituated to turning to our rivals for technical help, then we shall unquestionably see a trade, which has already sadly fallen, diminish further, and the splendid reputation for engineering which this kingdom has enjoyed in the East will dwindle away.

### Pure Metals.

The practical engineering interest attaching to pure metals—in the scientific sense of that term—would at first sight appear to be extremely limited. The engineer has long realised that the materials

with which he has to deal can claim, at the best, nothing more than "commercial" purity, and this, as is well known, varies from something like 99.95 per cent. to as little as 95.0 per cent. in some unfavourable cases. At the same time, it is well understood that although perfectly pure metals would, as a rule, be of very little value from the point of view of mechanical strength, yet the presence of certain impurities, even to a very minute extent, becomes not only objectionable, but in some cases renders a metal entirely useless for engineering purposes. The stringent steel specifications which turn upon hundredth of a per cent. of impurity are striking examples of this kind. Yet even in this very important case we find, on looking into the matter, that we do not know nearly as much about these things as would seem desirable or even necessary. Not long ago, when the revision of certain standard steel specifications was under vigorous discussion, the question was raised upon what basis the stringent requirement of a limit of 0.035 per cent. for sulphur and phosphorus was really based—and an entirely satisfactory answer was not forthcoming. There does not appear to exist any classical series of exhaustive tests showing the progressive influence of either sulphur or phosphorus on a series of steels, otherwise pure, in which that particular impurity alone varies progressively.

It is, probably, the lack of such systematic information regarding the effects of impurities which lies at the base of an effort, now being contemplated by the Department of Scientific and Industrial Research, mainly through the National Physical Laboratory, to place our knowledge of metals on a new basis by the study, in the first instance, of specially prepared pure metals. The study of such extremely pure materials, made at considerable expense under laboratory conditions, will not furnish data which can be directly applied to engineering materials—or even to materials ordinarily available for scientific purposes. Yet that study will have particular importance in two directions. There is, first, the possibility of re-determining on a more satisfactory basis, the physical constants—thermal, electrical and others—of the most fundamentally important metals. Such re-determination, if carried out with the best modern resources and adequate scientific skill, will be of permanent value. Such quantities enter not only into all kinds of scientific calculations, but frequently furnish the basis for establishing units of direct commercial importance. As an example, we may recall the fact—taken from a somewhat different but analogous field—that the highly scientific determinations of the "absolute" electrical units—ohm, ampère, &c.—have had a direct and important effect on the rating of commercial electrical appliances. It is, however, in the other direction, already indicated above, that the study of pure metals will yield its most immediately valuable results. It is, indeed, only by such study that the real effects of impurities and small intentional additions can be correctly determined. The data regarding pure metals are needed to furnish a reliable base line upon which to found really sound knowledge of the part which each more or less unavoidable impurity plays in moulding the properties of commercial products. The importance of this point of view is, fortunately, receiving full recognition at the hands of practical men who have to handle commercial metals in large quantities. Thus, the Non-ferrous Metals Research Association is actively interesting itself in this question of the study of pure metals and their physical constants, while it has placed in the forefront of its research programme the systematic study of the effects of impurites on the most important metals with which it has to deal, viz., copper and aluminium. In both these cases, the preparation of the purest possible metal constitutes the first step. In the case of copper, electrolytic refining provides a material of a very high purity, but the total elimination of oxygen presents a problem which has not yet been entirely solved. In the case of aluminium, the difficulties are much greater, and aluminium which is free from impurities, even to the extent of one part in a thousand, has yet to be prepared, although German metallurgists claim to have evolved a method capable of achieving such a result. Here there is the further difficulty that the art of the analytical chemist still lags behind that of the metallurgist to the extent that it is difficult to be sure of the amount of oxygen or carbon which a given sample of aluminium may contain. In the case of iron, some very pure samples have been prepared, but there also the estimation of the oxygen is a matter of serious difficulty.

It may, perhaps, seem that this type of research work is of too refined a nature to be of direct practical interest, but if the situation is properly appreciated, it will be seen that that is not the case. We are, as we have often pointed out, face to face with extremely keen competition, especially in metallurgical matters, and our competitors will not fail—and, indeed, are certainly not failing—to make use of every refinement to secure a better or a cheaper product. It is only by definite, accurate knowledge of the effects of impurities that we can hope to determine exactly where we can gain improved qualities by the elimination of certain elements, even in minute quantities, and where, on the contrary, our present refining processes are carried needlessly far. Here, as everywhere, it is only accurate knowledge that can help us to produce the best material for a given purpose at the lowest price.

## French Motor Car Design.

An inspection of the vehicles at the Salon de l'Automobile in Paris shows that there is a more pronounced tendency to settle down to definite types of power and transmission mechanism than has been observable at any previous exhibition of this kind. In the first place, manufacturers are certainly influenced by the design of certain small cars which are meeting with an extraordinary popularity, and the public is so far impressed with the satisfactory behaviour of this type that the makers of bigger and more expensive cars have found it desirable to follow upon similar lines. Thus the majority of builders are coming back to a system of engine design and to a grouping of the mechanism in which there is nothing that is really new but much that has only been rendered satisfactory by metallurgical progress as applied to aviation and to automobile engineering. The fact that experience in racing car and aviation engine construction, and the success of certain popular cars all tend to the creation of a settled type would seem to imply that the industry is approaching something like finality, until such time, at least, as a new departure in the way of cheaper fuels, for example, suggests a way of obtaining better results by other means. For the moment, the trend of the French industry is in the direction of single-power units, with one housing for the crank shaft chamber, clutch and gear-box, and with central change speed and brake levers. There are still many chassis with the gear-box separated from the engine, but at the Salon they were entirely overshadowed by the single-unit type. Automobile engineers have done the best they can in the way of providing thoroughly reliable cars capable of travelling at high speeds, and they now aim more particularly at ensuring greater safety and comfort. The speed limit having been suppressed in France and replaced by road regulations for all types of vehicles, much heavier responsibility devolves upon car owners in case of accidents through their own fault. It has therefore become necessary to ensure absolute control over the vehicle under all conditions of running. Hence the more careful attention paid to details, the greater importance attached to the purely mechanical problems of car construction, the improvements carried out in suspensions and the fitting of brakes on all four wheels. The motor car has long since passed the stage of compromise and makeshift, and the high-grade vehicle to-day is a remarkable product of engineering. In some cases it is a complete power-generating plant producing electrical energy for self-starting and for lighting the vehicle, and even driving a compressed air pump for inflating pneumatic tires. There is no effort at cheapness of construction; on the contrary, costly refinements are often introduced, and yet there does not appear to have been any appreciable increase in prices. On the other hand, cheapness has necessarily to be studied in the small car, voiturette and cycle car. These light vehicles were crowded out of the Grand Palais and had to be relegated to the Esplanade des Invalides, with the result that there was a great deal of discontent amongst exhibitors, who agitated for an extension of the Salon by means of enclosures outside the Grand Palais.

In the design of engines the use of overhead tappet valves is becoming more and more general. The higher efficiency obtained by suppressing the side valve chamber and firing the gases in the mass has long been recognised, and the more extended employment of overhead valves on engines of touring cars has only been retarded by their somewhat noisy operation. This defect has now been overcome by improvements in valve mechanisms, derived largely from experience with aviation engines, and as the tappet gear is encased in a covering the engine is silent and has a particularly neat appearance. It is observable, too, that with the use of special steels carefully selected for aviation engines the valve gear parts are very much lighter than formerly. In the case of the Bignan engine tappets and valve springs have been replaced by cams acting on the valve stems. Two horizontal cams with bevel teeth on their faces are rotated by a bevel pinion on the half-time shaft. The four valve stems are attached to yokes with sleeves sliding on fixed stems. Each yoke has two rollers between which passes the edge of the cam. The cam edges are profiled to give the necessary valve lift, and while one operates the induction valves the other actuates the exhaust valves. As regards the number of cylinders the proportion between four and six appears to be much the same as it was last year, and a distinct innovation at the Salon was a 10 horse-power six-cylinder engine on a Mathis chassis. There is a tendency towards longer stroke engines and higher piston speeds, which, within limits, give a greater volumetric efficiency, but the economy of petrol claimed by some makers is due in large part to a reduction in the weight of the vehicle and to a higher mechanical efficiency. So long as petrol is practically the only fuel used there does not appear to be much opening for further progress in the efficiency of engines, but the possibilities of the future are foreshadowed in the results obtained with the heavy-oil high-speed engine constructed by Peugeot, who has adapted it successfully to commercial vehicles and has recently been demonstrating its application to touring cars. Nevertheless, some remarkable claims are made on behalf of a system of water injection whereby the apparently insuperable difficulties that have always been met with are claimed to have been overcome by the addition of a chemical product which has the effect of instantly decomposing damp vapour drawn into the cylinder. This product—colloidal palladium—is dissolved in water which is pulverised and introduced into the cylinder before the admission of the gas mixture. The vapour is immediately decomposed by the temperature of the cylinder walls and the oxygen facilitates the combustion of the gas, thereby economising, it is said, about one-half of the petrol consumption. It is also claimed to give a much greater smoothness and flexibility to the engine, while the instantaneous dissociation of oxygen and hydrogen and the more complete combustion of the gases leave the cylinders and piston heads perfectly clean. The experiments carried out on a number of cars during the past eighteen months certainly seem to confirm the claims made on behalf of the system, and may open up further research in the chemical treatment of water in association with petrol and heavy oil fuels.

The power unit with central change speed and brake levers is a reversion to a type that has been employed for many years and is now adopted by leading firms because it has secured the appreciation of car users. Some big makers fit the unit equipment with side levers, and others still adhere to a separate gear-box, while others again build chassis of both types; but it is evident that the power unit with central levers is becoming a standard feature. Self-starters are so general that they are fitted even to some of the voiturettes. The old system of storage battery with motor driving on the fly-wheel to start the engine is being superseded by a dynamo and motor grouped on the unit. The electrical combination of self-starter seems to have entirely driven out the various mechanical devices which have been introduced from time to time. Another reversion to an old detail is the disc universal joint of woven fabric which has entirely replaced the cardan joint. The fabric disc joint is quite satisfactory when working under angles of not more than 5 deg., but on some chassis this angularity is increased, and then there is bound to be a distortion of the fabric and a "whipping" of the propeller shaft. Where mechanical joints are employed they are much better designed and made than formerly.

In suspensions the problem that has confronted makers is to damp the big shocks without making the springs so strong as to suppress the elasticity necessary to absorb vibrations. As this cannot be done by the springs themselves some other device has to be employed, and while the springs are as flexible as possible some shock-absorbing apparatus is fitted between the axles and the frame. For years past the most popular types of apparatus have been based upon the resistance of the passage of a liquid through small orifices, and several new systems on this principle have been recently introduced, while on a small Lancia car the front springs have been suppressed and replaced by what is apparently a plunger acting on a spring in a cylindrical tube, and at the same time acting on the rebound against the resistance of oil. On several other small vehicles shock absorbers take the place of front springs, while on one car laminated springs are given up altogether, the suspension being obtained by spiral springs in cylinders acted upon through the medium of rollers between ramps, these rollers being connected up with the axles. The effect of the resistance of the rollers on the ramps is to provide a stronger reaction against shocks. There is, in fact, a considerable variety of devices, from compensating springs to cam arrangements, and on the whole the mechanical systems appear to be quite satisfactory.

Amongst the light cars a striking feature is the disappearance of the tubular chassis and the great improvement in the design and quality of workmanship. Most of the light cars follow the lines of the big vehicles, with the same housing for the crank shaft chamber and gear-box. This practice is due to the fact that a number of engine firms are now building units specially for light cars and voiturettes, and owing to the facility offered for assembling chassis with units and parts manufactured in large quan-

tities there is little inducement to makers to design and construct chassis of their own. Hence there is less variety in types than formerly, and the light car seems likely to settle down to something like the same uniformity as the bigger vehicle.

## The Future of Agricultural Lime.

About a year ago a Government agricultural authority read a paper exhorting farmers to go back to the ways of their forbears and use more lime, and the somewhat depressed lime industry looked forward to improved business. More recently, however, we have had a definite pronouncement from an equally reputable authority that the use of burnt lime in agriculture is all wrong, and that the correct material to use is the natural limestone or carbonate in a fine state of subdivision. The cup of hope which was being raised to the lime producers' lips has thus been rudely brushed aside, and developments are being awaited with ill-concealed anxiety.

It would be outside our province to discuss critically the two opposing dicta cited above, and we shall not go beyond saying that the latter has been steadily gaining the support of scientists during recent years. What we are concerned with here is the effect of the change-over—supposing it comes to pass—upon the economics of the important industry of lime burning. It might be hastily assumed that as lime producers are in practically every case limestone producers, it would not matter in which form the material was sold. But there are two or more prominent errors of supposition here. In all lime works of any magnitude various markets are catered for, the farmer, the chemical manufacturer, and the builder being three prominent buyers. Now, in the ordinary form of limekiln built of limestone blocks lined with fire-brick, the limestone feed is mixed with the fuel—coal or coke, as the case may be—and it is inevitable that some of the burnt lime contains ash and clinker. For such lime it is desirable, nay, imperative, if production costs all round are to be kept down, that there should be an available market where specifications and analyses do not obtrude, and where the presence of a little dirt or unburnt stone does not lead to recriminatory correspondence. Such a market is found in agriculture, and if it did not exist it is difficult to see how the best hand-picked lump or other high-grade material could continue to be sold at the customary gradation of prices. True, there are some builders who say that lime containing ash and clinker is preferable for mortar making to the purer product, but we doubt if this view is widely held. The producer of lime for various markets, then, appears likely to be seriously affected in his economy of working if the agricultural demand were withdrawn, while the effect on those works whose main business is with the agriculturist could be little less than disastrous. Unlike the two or three large concerns which each produce the best lime in England, their lime is probably not of the highest purity chemically nor could they compete in distant markets owing to the incidence of railway rates. Certainly we come across glaring anomalies in this respect, as in one important commercial centre lime which has come 170 miles by rail is being sold at the same price as that which has had a journey of under 30 miles. There may, of course, be a different cost of production, but it is obvious that the ton-mileage rate is very different. Indeed, it is more than obvious; it is a fact.

Then the transition from lime to powdered limestone is not a particularly simple matter, because new plant is requisite. At the present time the principal purchasers of carbonate of lime are horticulturists and allotment holders rather than agriculturists, and the business is catered for by certain quarry owners in the North of England, at a retail price of 3s. or 4s. a hundredweight. The limestone is commonly ground in a ball mill to pass a fine mesh. Such grinding installations and the motive power mean, of course, new capital expenditure for lime burners, and it has yet to be proved that the product can be produced at a price to suit the farmers' ideas.

Now for another important consideration which should give pause to lime producers who may be disposed to adapt their plant to the supply of ground limestone. In the manufacture of caustic soda from sodium carbonate by means of caustic lime, there is a large amount of what is known as lime mud produced. Roughly speaking, half of this is a finely divided carbonate of lime, with a little caustic lime and a small amount of caustic soda, varying according to the care with which it has been washed, the rest being water. The disposal of this lime mud, which is produced to the amount of two tons for every ton of 70 per cent. caustic soda made, has always been a thorny problem for the chemical manufacturer. The uses that have been found for it so far have only called for quite a small amount of the total production, except in those few cases where it is utilised on the spot in making Portland cement. A fairly large amount, after being specially purified, finds a sale at from £4 to £5 a ton for treating upland waters which, when undealt with may have a deleterious action upon metals. A suggestion was once made that it might be sold for tooth powder, a use which could not do much to diminish the huge heaps of material available. In many works it has been a serious problem how to find sufficient ground for its disposal, and the local farmers who have carted it away for nothing have been hailed as benefactors.

Now, however, with the turnover from lime to limestone, the agricultural expert has come upon the scene, and is urging the chemical manufacturer to renew his efforts to get the slimy stuff into a dry portable form, so that it can be put upon the fields at a price that will satisfy both seller and buyer. With regard to the results which have been obtained recently by applying new methods of dehydration, we prefer not to say anything definite on this occasion, but it would certainly seem that some very satisfactory achievements have rewarded the efforts of experimenters, and we shall be surprised if important developments do not follow in the near future. A good deal will depend, of course, upon the economy of the drying process. For sale in bulk for agricultural purposes, cheaper procedure than that at present adopted by chemical manufacturers is essential if the price is not to be prohibitive. As to the manurial value of the carbonate of lime mud, there can be no doubt, as it is a precipitated carbonate, and hence in an extremely finely divided condition.

Turning for a moment to statistics, according to the official returns, we produce somewhere about 12 million tons of limestone yearly, but there are no details available, to the best of our knowledge, as to the disposal of this amount, or as to how much is burnt for lime. In America the Geological Survey gives more information, and we see that out of a total production in 1919 of about 25 million tons of limestone, among the industrial applications was agriculture, which took 1,392,914 tons. Presumably, this was not used as carbonate, because the production of lime for the same year was about 4 million tons, of which about half a million tons went for agriculture; so it is safe to assume that the great bulk at any rate of the limestone debited to agriculture was burnt for lime. These American statistics with regard to limestone and lime are so much in advance of anything we seem to have attempted at home that we have thought them worthy of special reference as a possible spur to one of our Government Departments to emulate them—a suggestion for which we feel sure the compiler of our mineral statistics will not thank us.

Though we have no desire to take too gloomy a view of the eventualities which the isolated country lime works may have to face, we cannot forbear reference to another fact of some import. This is the supply of agricultural limestone powder by limestone quarry owners, who do not make lime, but already have crushing facilities available. In this category come iron-smelting firms and Portland cement manufacturers. We are not raising a bogey in referring to opposition from such sources, as it is already a fact. As in the case of lime, however, locality will always be an important matter having regard to the incidence of railway freight charges, and no doubt in most cases the lime companies will be able, *mutatis mutandis*, to retain their local business when the farmer has been converted to the use of powdered limestone instead of caustic lime. [We say in most cases, because something will depend upon the type of kiln in use. We have already referred perhaps in a somewhat bantering tone to the condition of the agricultural lime as drawn from the vertical continuous kiln with mixed feed. Perhaps it may not be superfluous to state, in case some producer should feel aggrieved at our remark, that another type of kiln has come into increased use of recent years. This is the vertical kiln with separate feed. It usually consists of a steel cylinder lined with fire-brick and having two fire-places, which are built into the sides of the kiln, so that the fuel is not mixed with the limestone. It is obvious, therefore, that none of the lime can be contaminated with fuel ash.

## Literature.

*Patents for Inventions.* By J. Ewart Walker, B.A., and R. Bruce Foster, B.Sc. London: Sir Isaac Pitman and Sons, Limited. Price 21s. net.

Among the books published on patent law of a kind which will be acceptable to engineers, the above work will probably take a prominent place. It is not long, and the subject, although dealt with in a strictly legal manner, is so approached that it can be readily comprehended by those not already familiar with patent practice.

The object of the book, as stated in the preface, is to set out clearly and concisely the present law and practice relating to patents for inventions in such a form that it may be readily comprehensible to those directly or indirectly interested from the point of view of protection and commercial exploitation. To assist those not familiar with the law, the statutes which govern it are given in full, together with the patents rules. One or two passages in the text apparently should be amplified to explain the matter more fully. For example, in the case of an application by a company, the directions as to the affixing of the seal do not appear to be complete, because in some cases not only should the secretary or other responsible official sign, but, according to the articles of association, it may be that two directors and the secretary must add their signatures.

The purely legal sections of the book are extremely well written and contain much valuable information. Separate chapters are to be found on the interpretation of the complete specification, the validity of the patent, the rights of the patentee, and, what is equally important, the liabilities of a patentee.

As to interpretation, it is pointed out that the meaning of the document must be gathered from the words used and construed in the light of the state of knowledge in the art or manufacture at the date it was published. The extent and limit of the monopoly granted must be gathered from the claims read in the light of the rest of the specification. This matter has been fully considered in court in many patent actions, and is one to which inventors should give special attention in connection with their patents. Publication of an invention by prior user and also by prior written publication is explained with reference to decided cases. The text itself does not definitely apply these cases, but rather makes brief reference to the specific points decided, and indicates these references by means of a series of numbers corresponding to the cases which are cited in a table at the end of the book. In a publication of this size, it would hardly be practicable to do more.

In order to show the rapidity with which books on legal subjects are likely to require revision, it is noted that the circumstances in which specific references are generally inserted in patent applications warning the public of prior cases in which patents have been granted, will probably be varied in view of a recent decision in the High Court in which the judge gave his own views on these references.

In the chapter which deals with the rights of a patentee, the effect of war legislation is considered, and this section will be of use to all those who are interested in foreign patents—that is to say, in patents obtained in this country on the basis of those filed abroad.

Patents restored under the treaties of peace are also briefly considered, and as many of these have been effected, it is appropriate that the general conditions and obligations should be explained, although of necessity such explanation must be brief.

In the reference to the liabilities of a patentee, a short paragraph devoted to the effect of a judgment in the High Court will be read with interest, for it explains what is not sometimes appreciated, that the judgment does not void a patent, but is merely a judgment between parties—that is, of course, judgment given in an ordinary action for infringement of a patent, and not in revocation proceedings.

The decided cases to which reference is made comprise a long list in which there are several typographical errors. "A. F.'s" application appears to be out of order in the list, and confusion in the indexing of the actions beginning "Mac" and "Mc" has resulted in "Mackelcan" appearing as case No. 307, whereas "Mackie" is given the number 302. Apart from these slight alterations, the table as a whole is very serviceable, although it might with advantage have included a reference to the decision in "Z's" application, which is a leading case adopted by the Patent Office when considering what constitutes unity of invention. The index is extensive, as is required in a book of this nature.

### SHORT NOTICES.

*Life of Sir Guilford Molesworth, K.C.I.E.* Edited by E. J. Molesworth. London: E. and F. N. Spon. 1922. Price 5s. net.—It is difficult to say how this little volume could be correctly described. "Life" is too ambitious; "Autobiography" is barely correct; "Memoirs" is inadequate. It is, as a matter of fact, something of all three, and should interest those who find pleasure in the simple anecdotes of the tea-table or the garden chair. There is no attempt to give a serious account of the work of an engineer whose name is a household word amongst engineers. There are little anecdotes of his career told by Sir Guilford himself, and strung together with oddments of letters, newspaper cuttings, and so on. A book for the drawing-room or morning-room table rather than for the study.

### WESTMINSTER HALL ROOF.

We see from the sessional programme just issued by the Institution of Mechanical Engineers that on November 3rd Sir Frank Baines will deliver a lecture in the Home of the Institution on the repairs to Westminster Hall roof. We understand that the lecture will be illustrated by lantern slides, by the fine series of water-colour drawings made by an artist on Sir Frank Baines' staff, and by samples of the timber destroyed by the Death-watch beetle. We hear also that the Director of South Kensington Science Museum has consented to the fine model of the roof in the possession of the Museum being employed by Sir Frank for demonstration purposes. With a lively recollection of the wonderful little extempore lecture on the roof which Sir Frank Baines delivered last summer to the Newcomen Society, we can promise the members a more than ordinarily interesting evening. The subject has a purely architectural sound, but, as a matter of fact, the repairs presented an engineering problem of a fascinating kind, and the skill with which the work has been executed gives rise to the warmest admiration.

# Textile Machinery Exhibition in Manchester.

(*Continued from page 362.*)

A METHOD of air purification suitable for public buildings or factories which has much to commend it is shown by Herbert Smethurst and Sons, Limited, John Dalton, street, Manchester. The apparatus employed is called the "Vigoratair," and the principle on which the appliance works is that of internal purification by means of a current of air circulated through the apparatus, as a result of which the foul air is washed and freed from carbonic acid gas and matter in suspension. The apparatus is completely enclosed in a sheet metal case. The impure air is drawn in through the open top by means of a small electrically driven fan and leaves through the bottom.

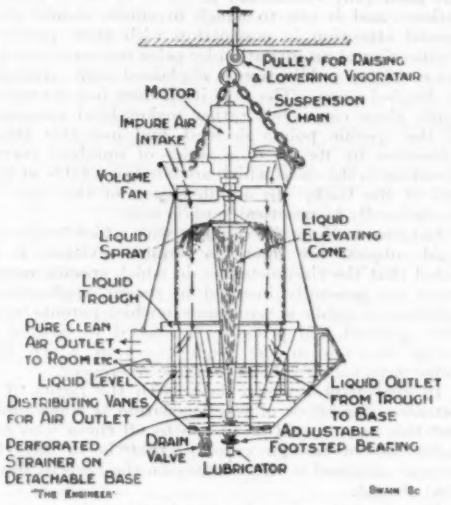


FIG. 4—THE VIGORATAIR

The circulation of the air and water within the casing is performed through a hollow inverted cone-shaped tube revolving in suitable bearings—see Fig. 4. At the top of the cone-shaped tube there is provided a shaft on which is fitted a fan, and an extension of the shaft is coupled to the motor shaft so that the fan wheel which induces the air current, and the cone-shaped tube which elevates the liquid, are all driven together. The cone tube at the base rapidly tapers to a point which is sealed by a short spindle suitable for the bottom bearing. The rapid revolution of the cone tube, which has a small hole at the lower end dipping in the water in the pan, causes the water to be elevated up the tube by centrifugal force. The water issues at the wide portion of the tube in the form of a film, which is converted into a spray on leaving the top, when it falls back by gravity to the pan reservoir. The fan fixed on the upper part of the shaft induces the vitiated air through the perforated cover and forces it down against and through the water spray, and it is eventually ejected through the vanes at the base purified and cleansed. The object of the vanes at the base of the apparatus is to prevent the water, under the influence of the rapidly revolving inner cone tube, from being sprayed through the air outlet.

The Youlten cotton opener, to which we referred very briefly last week, differs in principle from all existing opening machines in that the cotton is not beaten in the usual acceptance of the word, but is subjected to a more gentle treatment by rapid vibration in a current of air within a revolving perforated cage. As the cotton enters and leaves the machine freely the inventors claim that it cannot be damaged during its passage through the opener. Sectional views of the opener are given in Fig. 5, from which it will be seen that the machine consists of a frame R embracing a casing which contains the moving parts. These are the slowly revolving perforated cage B made up of four sections of sheet metal whose perforations may be all alike or varied; the rotary brush L, which makes contact with the external surface of the cage B and keeps it free from dust; and the rotor G, which lies within and at the bottom of the cage. This rotor is built up of stampings or laminations, of which there are 284, strung in double right and left-hand spirals on the shaft. Each stamping is rounded at the tip, and, consequently, in revolving at high speed the rotor presents an evenly serrated peripheral surface. The spiral formation of the stampings gives to the rotor the action of a conveyor, so that the tendency is for the cotton to be constantly moved towards the centre of the machine. In addition, a blowing fan delivers a current of air to the interior of the cage *via* the trunking E and the pipe D, the latter being adjusted in length to suit the length of treatment required, by extensions F. The cotton enters the machine through an inlet hopper A and falls upon the surface of the rotor, which, owing to its high rotational speed, is impenetrable, and as there is nothing to hold the cotton, it makes only momentary contact; but however brief that may be, it receives a number of light but extremely rapid taps or vibrations before being driven away with some force against the inner surface of the cage. This serves partially to break up or loosen the tufts, which fall back upon the rotor, or between it and the inner surface of the cage, and are carried underneath it, where they receive a rapid step-by-step raking from the serrations before being flung up into the space above. The spirality of the serrations of the rotor keeps the cotton in constant motion backwards and forwards in directions oblique to its surface, and causes a maze of intermingling streams of cotton which impinge obliquely upon the cage or rotor surface and *vice versâ*. The makers claim that the cotton is thus thoroughly opened up and the individual fibres loosened, which results in the elimination of almost all the microscopic dust adhering to the waxy surface of the fibres and a consequent brighter appearance of the cotton. As soon as the cotton is properly opened it is light enough to be influenced sufficiently by the air current from the pipe D, and is expelled through the outlet trunk H to the condenser or pair of dust cages. Dust and "fly" is drawn off through the cage *viâ* the space K and pipe Q to an exhaust fan or from the opposite side to the condenser fan, while the heavier impurities are trapped in the space K. The makers are Youlten Openers, Limited, Bridge-street, Manchester.

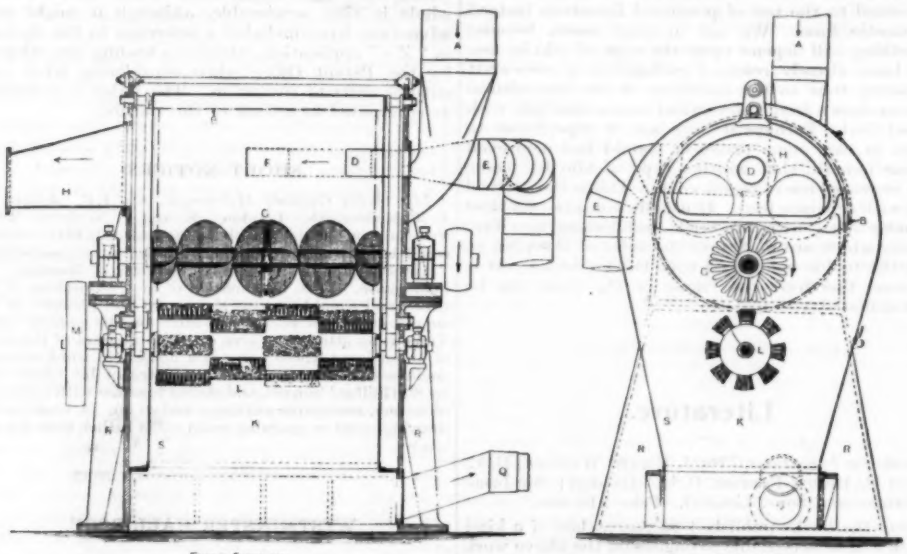


FIG. 5—YOULTEN COTTON OPENER

In the accessories section of the exhibition there are naturally a number of exhibits which have a general application, and prominent amongst these is a small working model of a steam turbine mechanical drive by the Metropolitan-Vickers Electrical Company, Limited, which is well worthy of inspection. Although, as shown in Fig. 6, it is specially designed for textile mill driving—a sphere in which the steam turbine has not yet made material headway—the plant would be equally adaptable to the operation of other kinds of factories. The engine-room of the mill is depicted equipped with a high-speed steam turbine, totally enclosed reduction gear, and rope wheel driving the shafting on the various floors of the mill. If it is desired to generate electricity, a generator can be added to an extension of the rope wheel shaft. In order to avoid loss of vacuum between the turbine and the condenser, the latter is placed immediately below the exhaust branch. Hitherto that arrangement has entailed a basement of considerable depth, or a total height from condenser floor level to engine-room ceiling greater than can usually be afforded in existing mills. In the installation shown the total height from basement to ceiling is only about 15ft. The company is making these machines in sizes varying from about 800 brake horse-power to 2000 brake horse-power, which is a range that should cover the requirements of most textile mills.

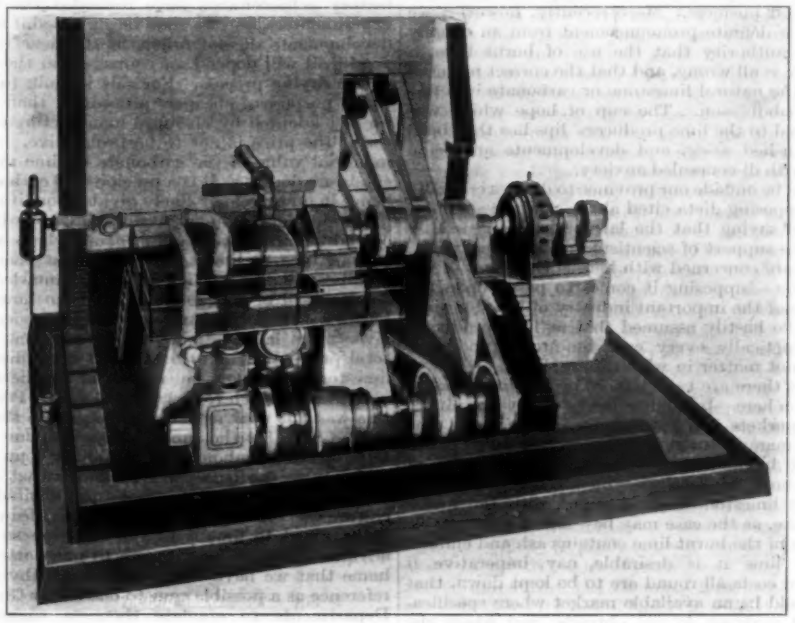

FIG. 6—MODEL OF TEXTILE MILL DRIVE

The model shows a condenser of the low-level multi-jet type in which the steam and injection water are intimately mixed. The condenser pumps are normally driven by ropes from the main turbine, and a small steam engine is provided for driving them until the turbine is up to speed after which the engine is cut out by means of a clutch. If electricity is always available for starting purposes a small motor could be used instead of this engine. In the arrangement shown in the model a small direct-current generator is also supplied, which can be driven by the engine or from the main turbine, two clutches being provided, one between the engine and dynamo and the other between the dynamo and the rope wheel. This should prove valuable for pilot lighting and when overhauls and repairs are being done throughout the mill at week-ends and holiday times. The main turbine is such that, if desired, it can be made suitable for passing out a quantity of low-pressure steam for heating the mill or drying, boiling, &c.

The electrical operation of textile machinery has made rapid strides during the last decade, and the British Thomson-Houston Company, Limited, has all along been prominently identified with this branch of engineering. On this account the exhibit of the Roxbrough control gear, shown by this firm, is of special importance. It is a new device for regulating the speed of ring spinning frame motors so as to maintain a constant tension on the yarn. The motor speed is varied in accordance with the rise and fall of the ring rail, and is also increased as the winding of the bobbin progresses. The control gear is placed within the end shield of the motor, making the motor and control gear a self-contained unit which is connected to the spinning frame only by the driving shaft and by a small chain which operates the controller shaft. By maintaining a constant tension, the speed of the ring frame can be increased to produce a greater output than that possible with the variations in tension which frequently exist. This gear is arranged to allow of adjustment in any direction whilst running.

Alternating-current commutator motors, which have been developed by this company to meet the demand for a variable-speed polyphase alternating-current motor, are also exhibited. This type of motor has practically the same speed characteristics within its normal speed range as a continuous-current shunt-wound motor. The normal speed range of these motors is 3 to 1, and this speed variation is obtained by the simple operation of altering the position of the brushes on the commutator, an external hand wheel being provided for that purpose. No special starting gear is required, the motor being connected to the line through an ordinary oil switch after the brushes have been set in the position of minimum speed running.

The Lancashire Dynamo and Motor Company, Limited, Trafford Park, shows a range of motors from ¼ horse-power upwards, a Crypto battery-charging plant of simple con-

struction, and a motor alternator set. James Gordon and Co., Limited, Windsor House, Kingsway, London, have a stand on which are shown models of water turbines, superheaters, feed heaters, and water flow recorders. Ferodo Limited, Chapel-en-le-Frith, show friction linings suitable for engineering purposes and specimens of Ferodo non-slipping stair treads. Thomas Broadbent and Sons, Limited, Huddersfield, and Laminated Gears, Limited, Sheffield, have a joint stand on which is shown a model consisting of a Parkinson 8 horse-power squirrel-cage motor with a Broadbent centrifugal clutch combined with "laminated" gears transmitting power to a brake drum. By "weighting" the brake lever any load up to or beyond 8 horse-power can be put on the motor and the torque registered on a spring balance, 200 lb. on the balance being equivalent to 8 horse-power on the motor. Hans Renold, Limited, Manchester, exhibit actual drives showing the application of the inverted tooth and bush roller chains and wheels for power transmission in textile factories. Running exhibits are to be seen showing modern practice in the arrangement of line shaft drives and the method of "modernising" old mills by replacing spur gear motors by Renold chain and wheels. Bolton's Superheater and Pipe Works, Limited, Stockport, show their well-known superheaters fitted with "Field" tubes. The Skefko Ball Bearings Company, Limited, Luton, shows a range of ball bearings suitable for all classes of textile machinery. The Bolton Moor Foundry Company, Limited, Bolton, is represented by a full size model of an 8ft. Lancashire boiler front to show the Bramwell automatic expansion joint, which is flexible and allows for expansion in all directions. In connection with steam boilers the Superheat Furnace Company, Limited, Bradford, shows a small model of a Lancashire boiler fitted with a new form of circulator which consists of inclined metal plates supported on brackets on top of the furnace crown. The bubbles of steam coming off from the furnace plates are shown rising and flowing with the heated water towards the cooler end of the water space owing to the deflection of the plates, which is claimed to indicate an improved circulation. A new electric furnace shown by Hancock and Co. (Engineers), Limited, Wallington, Surrey, is specially suitable for tool work, non-ferrous metals, &c. In this furnace the heat is produced by passing an electric current along a series of thick carbon rods run longitudinally up and down the length of the furnace, these rods being protected against oxidisation by a patented process, and being removable and replaceable in a few minutes without dismantling the furnace in any way. The same firm shows an oxygen-coal gas cutting-off machine and a circle-cutting machine. A new form of expanding pulley is shown by the Expanding Pulley and Electric Company, Thornhill Lees, Dewsbury. In this pulley the rim is composed of a number of segments with longitudinal serrations or steps which slide upon similar steps on a central portion, and in this way the peripheral speed is capable of a variation of 25 per cent. The pulley is made for any power from 2 to 200 horse-power.

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CARRIAGES with *couchette* sleeping accommodation for second and third-class passengers have been placed on the Paris-Brest route.

## A New Insulation Tester.

THIRTY-THREE years have elapsed since Mr. Evershed, of Evershed and Vignoles, Limited, first introduced his insulating testing set, which consisted of an ohmmeter and a hand-operated generator for testing insulation under pressure. Fourteen years later, namely in 1903, Mr. Evershed brought out his well-known "Megger" testing set, which, as all electrical people know, differs from the original arrangement in that all the parts are contained in a single box. The ever-increasing use of electricity has, however, given rise to a demand for an instrument, which, whilst thoroughly efficient, is also cheap.

A new instrument which we have recently inspected at Messrs. Evershed and Vignoles' works has been designed to meet the present-day requirements, and whilst it does not perhaps offer all the advantages of the more expensive "Megger" testing sets, it is, nevertheless, a very creditable production and quite suitable for meeting the requirements of the electrical contractor and many others who have to make insulation tests. In designing this new instrument, the makers have not only aimed at reducing the cost. The weight has also been considerably reduced, with the result that the instrument can be carried from place to place with ease. Complete and ready for use, the new instrument, which has been named the "Meg" insulation tester—to suggest its relationship to the company's well-known "Megger" testing set—weighs less than 7 lb., and its dimensions are only 5½in. by 7¾in. by 6¼in. This low weight has been obtained by the use of an aluminium case, and as far as possible aluminium parts, whilst cheapness has been secured by the omission of all refinements which could be dispensed with without detriment to efficient operation.

The general appearance of the instrument is shown in Fig. 1. At one end of the aluminium case an oil-tight gear box is formed, in which the steel gearing—shown in Fig. 2—for the generator is enclosed, so that it is kept clean and also well lubricated. The handle, which operates the generator and which is clearly shown in Fig. 1, is shaped and arranged so that whilst it is always ready for use, it does not project in a manner which would impair the snug packing of the instrument or lend itself to damage as the result of blows. Moreover, an ingenious free wheel device protects the gear from damage and prevents the armature of the instrument being turned in the wrong direction. At the opposite end of the instrument to that at which the operating handle is fitted, the enclosed ohmmeter is placed, and the "line" and "earth" terminals are housed beneath it. At the top of the instrument—see Fig. 1—a glass window with a hinged cover gives a view of the dial upon which the insulation resistance values are clearly marked.

The handles for carrying the instrument are designed so that when the instrument is in use they can be turned back at the side of the case, as shown in Fig. 1, so that the operator may have a clear view of the dial. When, however, the instrument is being carried from place to place, the handles are united by a flat spring catch. The reduction in the weight of the instrument has not been obtained at the expense of the working forces, which are large in proportion to the mass and inertia of the movement, and the indications are given with great promptness and precision. The makers' well-known system of guarded circuits has been adopted, and their patented spring jewels are employed for the movement and give security against damage by careless use.

As a low selling price is dependent upon production on a large scale, it has been decided that for the present, at any rate, the new instrument shall be manufactured in only one form, and that it shall be provided with a variable pressure generator developing 500 volts when running at

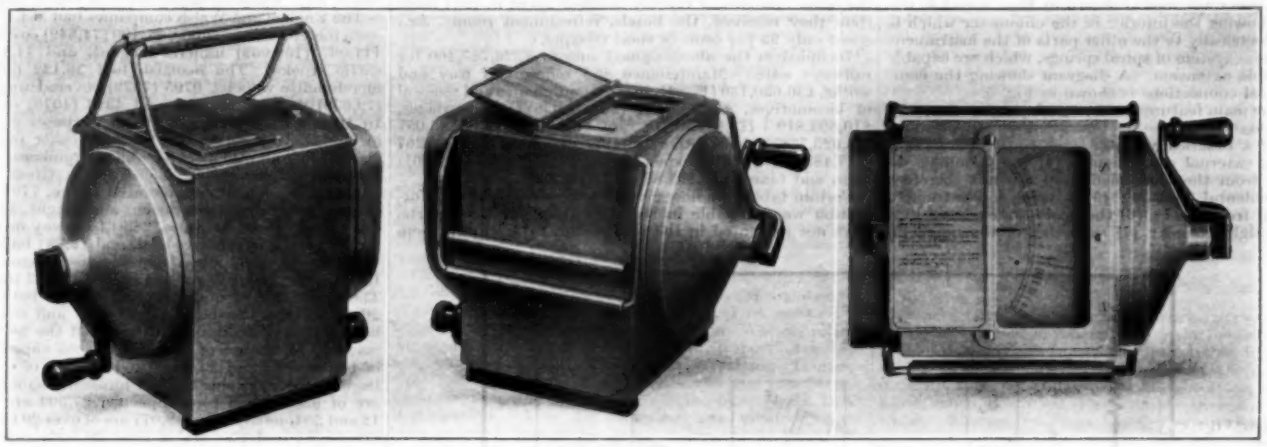


FIG. 1—THE "MEG" INSULATION TESTER

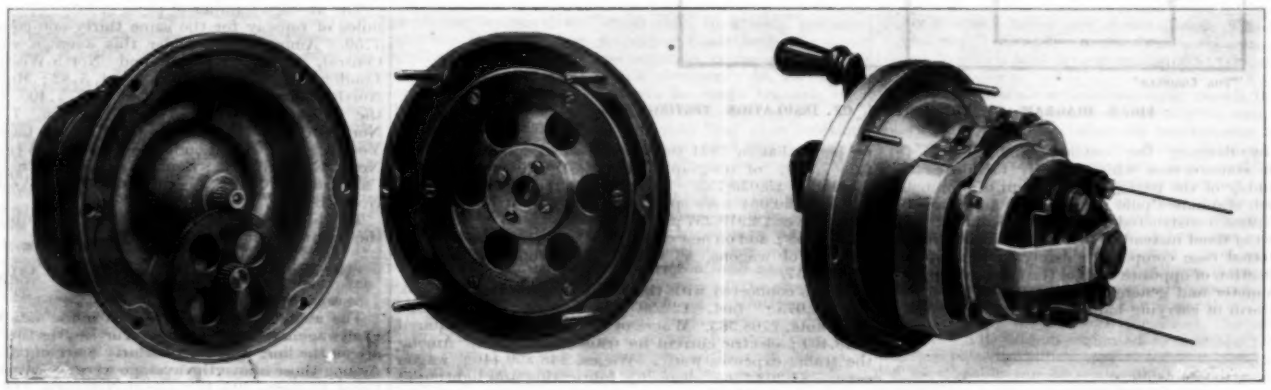


FIG. 2—GEARING

FIG. 3—GENERATOR UNIT

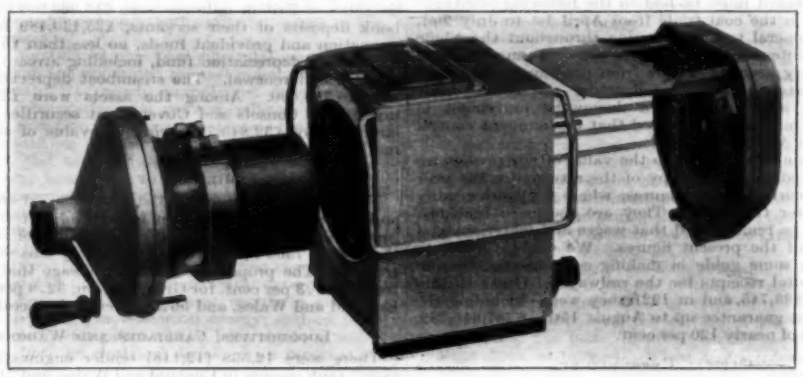


FIG. 4—INSTRUMENT WITH END COVERS REMOVED

100 revolutions per minute. The scales—see Fig. 1—are designed to give readings ranging from 0 to 100 megohms, and each scale is separately calibrated and marked in black on a white background. The instrument is sold with a light case composed of stiffened canvas, and having a strap for enabling it to be carried in the hand or to be slung on the shoulder. Space is available in the case for leads and small tools, and, if necessary, a packet of sandwiches. Although the firm's "Megger" testing set is an excellent instrument, it has the disadvantage of being somewhat heavy, and is too costly for the small electrical man, and there is no doubt that the new instrument fills a long-felt want. The generator unit is shown in Figs. 3 and 4, the latter also showing the interior of the ohmmeter which is connected electrically to the other parts of the instrument by an ingenious system of spiral springs, which are capable of considerable extension. A diagram showing the complete electrical connections is shown in Fig. 5.

Briefly, the main features of the new instrument may be summarised as follows:—(1) Considerable reduction of weight; (2) a practically water-tight construction; (3) reduction in external dimensions; (4) the terminals do not project from the instrument and are not therefore liable to accidental damage; (5) a novel and extremely light form of free wheel; (6) the gears are enclosed in a separate oil-tight casing; (7) reduction of the magnetic reluctance by flanging the outside laminations; (8) a concentric construction which greatly facilitates the correct assembly of the parts; (9) a design of ohmmeter magnet which eliminates pole pieces; (10) an ohmmeter movement frame constructed from one stamping; (11) the provision of fixed instead of moving ligament drums; (12) an external case composed entirely of aluminium; (13) the utilisation of opposite ends of the case for supporting the ohmmeter and generator; and (14) a novel and convenient form of carrying handle.

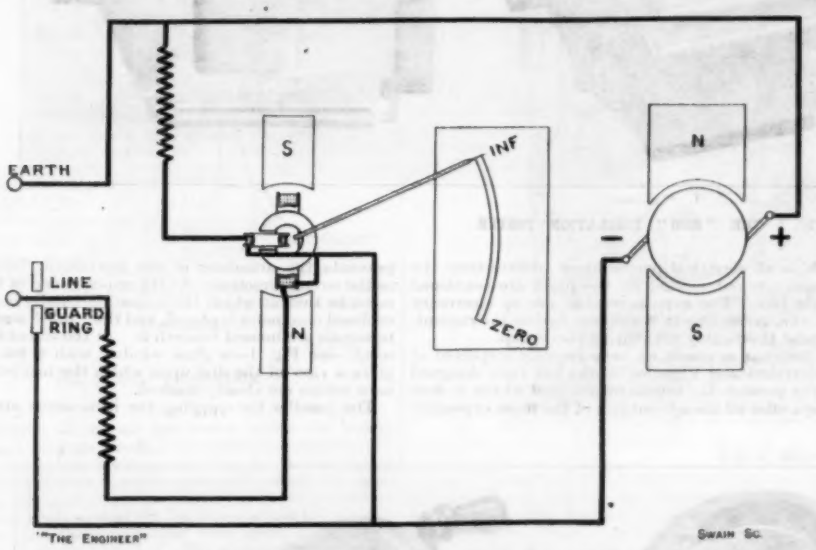



FIG. 5—DIAGRAM OF CONNECTIONS OF INSULATION TESTING SET

## The Railway Returns for 1921.

THE returns of the capital, traffic, receipts, working expenditure, &c., of the railways of the United Kingdom for the year 1921 were issued as a Stationery Office publication—price 2s.—on the 5th instant. They are contained in a Blue Book of 280 pages and, therefore, provide ample food for comment of interest to the general public, but we propose to deal only with those pages that appeal to engineers. We intend, also, to give the figures for Great Britain only, and not for the United Kingdom. In any consideration of these figures it is desirable to remember that last year was quite abnormal. As the general report observes, regard must be had to the following points:—Stoppages in the coal trade from April 1st to July 2nd, 1921; a general trade depression throughout the whole year; maintenance expenditure was on an abnormal scale, largely because arrears from preceding years were being overtaken; wages fell under the sliding scale agreement, and there was a downward movement in prices. It might also be noted that Government control lasted until August 15th.

As we think it will add to the value of our review, we have inserted, from our copy of the returns for the year 1913, the corresponding figures, where they are readily available, for that year. They are shown in brackets, and it will be remembered that wages and material stood then at half the present figures. We ought further to remark, as some guide in making comparisons, that in 1913 the total receipts for the railways of Great Britain were £130,833,745, and in 1921 they were—including the Government guarantee up to August 15th—£287,646,282, an increase of nearly 120 per cent.

### CAPITAL EXPENDITURE.

The railways of Great Britain spent on capital account during the year £1,370,116 (£6,054,642) on new lines and additions to existing lines; £1,664,228 (£1,903,878) on rolling stock; £687,171 (£168,069) on manufacturing and repairing works and plant; £958,888 (nil) on steamboats; £175,846 (£954,553) on docks; and £333,242 (£217,891) on electric power stations. These figures, with other items, made £5,106,690 (£10,066,997).

### EXPENDITURE.

The British railways spent in wages and material £246,156,337 during 1921 (£84,315,804 in 1913). The former sum was expended as follows:—On railways, £226,767,460 (£75,966,555); passenger road vehicles, £184,505 (£121,037); goods motor vehicles, £24,055 (not returned); steamboats, £4,994,316 (£2,412,325); canals, £702,060 (£744,051); docks, £7,143,266 (£2,447,508); hotels, refreshment rooms, &c., £6,277,031 (£2,485,549); other separate businesses, £63,644 (£38,781). In 1913 the expenditure was £84,315,804. The gross receipts were then £130,933,748, as compared with £287,646,282 for last year. For the whole of the United Kingdom the ratio of expenditure to receipts in 1921 was 104; in 1913 it was 62.62. It is not without interest to note that whilst all the other branches of railway business spent in 1921 more than they received, the hotels, refreshment rooms, &c., spent only 93 per cent. of their receipts.

Included in the above-named sum of £226,767,460 for railways were:—Maintenance and renewal of way and works, £36,630,130 (11,894,487); maintenance and renewal of locomotives, £24,343,454 (£6,052,038); of carriages, £10,693,819 (£3,649,833); of wagons, £14,243,057 (£3,625,778); locomotive running expenses, £52,652,267 (£17,485,994); traffic expenses, £67,101,771 (£23,469,596); rates and taxes, £10,803,858 (£4,770,263).

Certain tables are now given which, although the information was available in the companies' annual reports, were not presented in the returns for 1913. From them we learn that in 1921 the maintenance of signalling cost £2,667,729; of telegraphs, £1,108,319; of stations and buildings, £5,035,753. In complete renewal of locomotives £2,180,064 were spent, and on the purchase of new locomotives £2,912,257; in complete renewal of carriages, £1,637,458; and on new carriages, £1,625,416; in complete renewal of wagons, £3,518,840; and on new wagons, £4,053,257.

Wages connected with the running of locomotives took £22,304,075; fuel, £22,997,195; water, £1,011,882; lubricants, £768,333. Wages of electric trainmen required £848,464; electric current for trains, £2,056,309. Among the traffic expenses were:—Wages, £48,890,446; wagon covers, £1,202,236; cleansing, lubricating and lighting of vehicles, £3,294,656; working of stationary engines, hoists, cranes, &c., £1,705,293; coal, &c., tipping, £90,438.

For steamboats £1,186,792 were wanted for fuel, £982,897 for repairs, and £220,146 for harbour, pier and light dues. For docks £2,064,255 were spent on maintenance, and £821,694 on dredging. Of the £6,277,031 spent on hotels and refreshment rooms, £3,485,299 went in provisions, wines and spirits consumed, and £711,353 on repairs and maintenance of hotels and refreshment rooms and of the fittings, furniture, &c., of restaurant cars. For the generation of electrical power £158,523 were required for the maintenance of plant, machinery and tools, and £862,573 for fuel. The cost of distribution of the electrical power was £247,365.

The general balance sheet shows that among the liabilities of British railways were £12,964,909 for savings bank deposits of their servants, £25,130,489 for superannuation and provident funds, no less than £51,954,181 for railway depreciation fund, including arrears of maintenance and renewal. The steamboat depreciation fund was £6,786,600. Among the assets were £29,552,033 invested in Consols and Government securities, and the large sum of £32,845,769 being the value of stores and material on hand.

### MILEAGE OF LINE.

There were on December 31st, 1921, 36,751 track miles and 20,281 route miles open for traffic. Of the 20,281 route miles, 12,716 miles had a second line of track, *i.e.*, there were 7565 miles where the railway was only single tracked. The proportion of route mileage that is single track is 37.3 per cent. for Great Britain, 32.8 per cent. for England and Wales, and 56.2 per cent. for Scotland.

### LOCOMOTIVES, CARRIAGES AND WAGONS.

There were 12,538 (12,118) tender engines and 8792 (8697) tank engines in England and Wales, and 2122 (2043) tender engines and 879 (806) tank engines in Scotland. The 465 locomotives hired from the Government which the English and Welsh companies had at the end of 1920 had been reduced to 64 by the end of 1921, and a footnote shows that they were returned to the Government on January 1st last. The English companies had 64 (83) electric locomotives. There were on British railways 126 (208) rail motor cars, seating 6668 (10,836) passengers, 1409 (1006) electrically operated motor cars, seating 70,356 (50,477) passengers, and 1909 (1467) trailer cars, seating 104,190 (77,297) passengers.

The returns for 1913 did not distinguish between the types of railway carriages, and there were then on British railways 52,380 carriages, seating 2,510,885 passengers. Now there are as follows:—Of a uniform class, *i.e.*, all first, all second or all third, 36,290 carriages, seating 118,465 first class, 60,469 second class, and 1,718,212 third class; 11,860 composite carriages, seating 180,366 first class, 26,286 second class, and 345,366 third class. There were 516 restaurant cars, seating 5429 first class, 64 second class, and 10,530 third class. In the 154 sleeping cars there were berths or seats for 1511 first-class and 280 third-class passengers. There were 20,907 (20,935) "other coaching vehicles," *e.g.*, carriage trucks, horse-boxes, &c. These included 217 Post Office vans.

The English and Welsh companies had 354,575 (361,107) open merchandise wagons, 77,100 (74,849) covered wagons, 111,067 (106,065) mineral wagons, and 14,411 (15,161) cattle trucks. The Scottish had 36,122 (36,845) open merchandise wagons, 9705 (7929) covered wagons, 75,357 (79,639) mineral wagons, and 4393 (4076) cattle trucks. In 1913 wagons used for special purposes were included in the above list, whilst those for other purposes were classed as "all others." The latter numbered, for British railways, 52,689. Now there are in Great Britain, in addition to what are enumerated above, 7709 wagons for loads of exceptional dimensions and weight, 35,533 timber trucks, 13,785 brake vans, 28,913 railway-owned wagons for conveying locomotive coal, and 12,791 ballast wagons.

Of the 390,697 open merchandise wagons in Great Britain, the majority are between 8 and 12 tons capacity. There are 7255 of under 8 tons, 2266 of between 12 and 20 tons, 1146 non-bogie of 20 tons and over, and 145 bogie fitted of 20 tons and over. Of the 86,805 covered wagons, 10,145 are of less than 8 tons capacity, 801 are of between 12 and 20 tons, and 159 are of over 20 tons, bogie fitted. Of the 186,424 mineral wagons, only 2959 are of less than 8 tons capacity, 27,509 are of between 12 and 20 tons capacity, 18,077 are of over 20 tons capacity, non-bogie, and 235 are of over 20 tons capacity, bogie fitted.

### COAL AND LUBRICATING OIL CONSUMPTION.

The average coal consumption per engine mile of thirty-one principal railways was 54.80 lb. Those below the average included:—Great Eastern, 53.07; Great Western, 43.75; London and South-Western, 41.91; London, Brighton and South Coast, 47.30; Midland, 53.76; North-Eastern, 51.62; North Staffordshire, 49.45; South-Eastern and Chatham, 51.46; Taff Vale, 49.69. Among those above the average were:—Great Central, 62.59; Great Northern, 63.71; Lancashire and Yorkshire, 55.49; London and North-Western, 60.69; Caledonian, 70.95; Glasgow and South-Western, 66.19; North British, 62.90.

The average number of pints of lubricating oil per 100 miles of railway for the same thirty-one companies was 7.59. Among those under this average were:—Great Central, 7.31; London and North-Western, 7.19; London, Brighton and South Coast, 5.82; Midland, 5.14; North Staffordshire, 7.35; Taff Vale, 7.40. Those above the average included:—Great Eastern, 7.75; Great Northern, 8.04; Great Western, 7.79; Lancashire and Yorkshire, 7.84; London and South-Western, 8.75; North-Eastern, 7.82; South-Eastern and Chatham, 7.85; Caledonian, 10.92; Glasgow and South-Western, 9.93; North British, 7.87.

The above figures must be read in conjunction with those now about to be given.

### WAGON MILES, WAGONS FOR TRAIN AND WAGON LOADS.

The average number of wagon miles, *i.e.*, the mileage of all wagons, per train engine-hour, *i.e.*, the time the engines are on the line, was, for the thirty-one companies, 256.26. Among those above the average were:—Furness, 299.18; Great Eastern, 295.10; Great Northern, 284.89; Great Western, 259.46; London and North-Western, 275.50; London and South-Western, 322.46; London, Brighton and South Coast, 272.15; North-Eastern, 312.55; Caledonian, 263.77; Glasgow and South-Western, 282.23. Among those below the average were:—Great Central, 241.83; Lancashire and Yorkshire, 218.86; Midland, 240.23; South-Eastern and Chatham, 193.38; Taff Vale, 179.64; North British, 218.81.

The average miles per shunting hour—this figure reveals the time spent in shunting in proportion to the mileage of the wagons—was 216.96. Those companies below this average included:—Furness, 164.32; Lancashire and Yorkshire, 128.37; London and South-Western, 150.54; London, Brighton and South Coast, 159.71; North-Eastern, 183.73; North Staffordshire, 126.52; South-Eastern and Chatham, 137.31; Taff Vale, 104.19; Caledonian, 179.77; Glasgow and South-Western, 203.65; North British, 171.51. Among those above the average were:—Great Eastern, 275.62; Great Northern, 347.24; London and North-Western, 271.15; Midland, 309.39.

The average number of wagons per train was 34.49, and the average load per wagon was 5.07 tons. The principal averages were:—Great Central, 39.96 wagons of 5.95 tons; Great Eastern, 32.81 wagons of 4.71 tons; Great Northern, 41.44 wagons of 5.02 tons; Great Western, 35.83 wagons of 5.34 tons; Lancashire and Yorkshire, 36.64 wagons of 4.63 tons; London and North-Western, 38.23 wagons of 4.53 tons; London and South-Western, 34.08 wagons of 4.19 tons; London, Brighton and South Coast, 34.06 wagons of 4.60 tons; Midland, 34.95 wagons of 5.53 tons; North-Eastern, 36.85 wagons of 5.66 tons; North Staffordshire, 29.43 wagons of 4.66 tons; South-Eastern and Chatham, 30.67 wagons of 4.69 tons; Taff Vale, 26.89 wagons of 9.38 tons; Caledonian, 28.24 wagons of 4.24 tons; Glasgow and South-Western, 26.97 wagons of 4.09 tons; North British, 28.49 wagons of 4.62 tons.

### AVERAGE TRAIN LOAD AND NET TON-MILES.

The average train load was 121.17 tons. Those companies exceeding this figure included:—Furness, 133.35; Great Central, 153.28; Great Northern, 144.51; Great Western, 133.61; London and North-Western, 127.61; Midland, 129.28; North-Eastern, 140.11; Taff Vale, 137.09. Those under the average included:—Great Eastern, 105.88; Lancashire and Yorkshire, 117.51; London and South-Western, 103.65; London, Brighton and South Coast, 108.79; North Staffordshire, 103.57;

South-Eastern and Chatham, 102.06. The North British, with 95.43, was the highest Scottish company.

The net ton-miles, i.e., tonnage combined with distance, per train engine-hour averaged 900.57. Among those with a higher average were:—Furness, 1317.61; Great Eastern, 932.73; Great Northern, 989.21; Great Western, 965.07; London and North-Western, 910.33; London and South-Western, 975.07; North-Eastern, 1200.73; Taff Vale, 915.64. Those with a lower average included:—Great Central, 867.27; Lancashire and Yorkshire, 697.17; London, Brighton and South Coast, 864.08; Midland, 885.79; North Staffordshire, 780.96; South-Eastern and Chatham, 642.57; Caledonian, 834.06; Glasgow and South-Western, 870.94; North British, 793.63.

Very valuable information is furnished by the column "Ton-miles per route mile per working day." This column shows the density of the traffic. The average was 2156, and those lines with a higher average were:—Great Central, 3694; Great Northern, 3236; Great Western, 2319; Lancashire and Yorkshire, 2744; London and North-Western, 2734; Midland, 4667; North-Eastern, 2236; Taff Vale, 3218. Those below the average included:—Furness, 1274; Great Eastern, 1861; London and South-Western, 981; London, Brighton and South Coast, 995; North Staffordshire, 1512; South-Eastern and Chatham, 1101; Caledonian, 1371; Glasgow and South-Western, 1210; North British, 1520.

### Electric Traction.

There were 112 route miles and 212 track miles equipped for electric traction over which only electric trains ran, and 259 route miles and 620 track miles over which both steam and electric trains worked.

The total mileage run was 31,353,102. The consumption of current amounted to 327,593,075 B.T. units, whilst 36,337,923 B.T. units were used for other purposes than traction.

The London Electric ran 6,283,168 train miles; the Metropolitan District, 5,103,039; Metropolitan, 4,555,544; London and South-Western, 3,608,588; Lancashire and Yorkshire, 2,136,583; Central London, 2,021,486; City and South London, 1,384,465; London, Brighton and South Coast, 1,254,113; London and North-Western, 1,086,560.

The North-Eastern ran 785,818 passenger train miles and 55,055 freight train miles.

## Fuel Economy.*

No. III.†

### VII. Smoke Abatement.

During the past year the Departmental Committee appointed by the Ministry of Health "to consider the present state of the law with regard to the pollution of the air by smoke and other noxious vapours, and its administration, and to advise what steps are necessary and practicable with a view to diminishing the evils still arising from such pollution," has issued its Final Report. After full consideration of the matter, it was not thought practicable at present to propose legislation dealing with smoke from private dwelling-houses, although it was estimated that as much as 2½ million tons of potential fuel in the form of soot escape annually into the atmosphere from domestic fire-places, as against only 500,000 tons from factory chimneys, which latter seems a very low figure. It was, however, recommended that the Central Housing Authority should have certain supervisory powers in regard to heating methods over housing schemes submitted by local authorities, and that the latter be empowered to make by-laws requiring the provision of smokeless heating arrangements in new buildings other than private dwelling-houses. This is probably as far as it is practicable to go in the present state of public opinion; for it seems wiser to rely upon its further education and enlightenment rather than upon vexatious legislative prohibition for the abatement of domestic smoke.

With regard to the question of industrial smoke, it was recommended by the Departmental Committee: (1) That the Ministry of Health should be given clearly defined power to compel or act in place of any defaulting authority which refuses to perform its duties in administering the law with regard to smoke; (2) that, instead of the present absolute prohibition, which it is impossible to observe, there should be imposed upon all manufacturers, users and occupiers of any business premises or processes, engines or plant of any description whatever, a general legal obligation to use the best practicable means, having regard to all the circumstances of the case, including the question of cost, for avoiding pollution of the air by smoke, grit, or any other noxious emissions; (3) that the same law should also apply to all Government establishments, and all rail and road locomotives and motor cars of whatever weight and type, and to steamers on rivers, estuaries, and lakes; (4) that the Ministry of Health should be empowered to fix smoke standards from time to time; (5) that the duty of enforcing the law with regard to the pollution of the air by smoke should be transferred from the local sanitary authorities, in whose jurisdiction it now rests, to the county authorities—*i.e.*, the Councils of Counties and County Boroughs—albeit that minor authorities should still have the power to take proceedings, if they so desire; (6) that for proved breaches of the law much larger fines should be imposed than at present; and (7) that the Minister of Health should assign to one or more competent officers the duty of advising and assisting local authorities and manufacturers with regard to difficult smoke problems, and that such officers should report annually in the steps which are being taken, and the progress which has been made, in the suppression of avoidable smoke.

Since its inception in 1915, this Committee of the Association has carefully considered data and proposals relating to the causes and prevention of industrial smoke, and has been pleased to note progressive improvement, due largely to the increasing study of fuel economy in its various branches in regard to smoke abatement throughout the country, and that the Ministry of Health has taken evidence with a view to passing further legislation on more rational lines than that at present existing, which has become very much of a dead letter by reason of the extreme remedies it proposes.

It must be remembered that, even with the best appliances used with the greatest care, it is practically impossible altogether to prevent black smoke being produced for some small portion of the time when raw bituminous coal is burnt, and that in some industrial operations more smoke is apt to be produced than in others. It is evident, therefore, that no legislation should penalise the emission of what may be reasonably considered to be the minimum amount of smoke by competent judges who are familiar with the nature and the requirements of the particular industrial operation concerned. Indeed, it may be predicted that any attempt to do so would probably be as ineffective as the present enactments, and would thereby merely defeat its own purpose.

This Committee, having carefully considered the matter in its various aspects, has come to the conclusion that the best way of further abating the pollution of the atmosphere by smoke would be the institution by the Ministry of Health of a national Smoke Inspectorate on similar lines to the already existing Alkali Inspectorate, which has admittedly worked well and with beneficial results to the industry concerned.

*Changes in Membership.*—Since its last reappointment the following changes have taken place in the membership of the Committee. Mr. E. Bury retired on account of frequent absence abroad; Sir Joseph Walton retired on account of ill-health, and Mr. Robert Armitage was co-opted in his place. Mr. Wallace Thorneycroft has been co-opted in the place of the late Mr. G. Blake-Walker, and Mr. E. Myers in the place of Mr. D. V. Hollingworth. Also the following new members have been co-opted during the year: Messrs. J. E. Hackford, H. Stafford Rayner, L. L. Robinson, and W. C. P. Tapper.

The Committee recommends that it be reappointed to continue its investigations, with a grant of £5.

### Appendix.

*Memorandum on Determining the Efficiency of Cooking Appliances.*

The efficiency of appliances for the utilisation or transformation of heat energy cannot be regarded so definite a function as in the case of mechanical or electrical ones. Since no non-conductor of heat is known, the actual thermal efficiency, however determined, must be variable according to the conditions.

In the case of cooking ranges and appliances, the conditions are so variable and complicated that it is difficult to devise test methods which shall invariably produce approximately the same numerical result from the same appliance on two or more separate occasions. Unless this is done, any figures must necessarily be uncertain, and no reliable comparison can be made between two different appliances in respect of efficiency.

In order that such figures should bear close relation to the efficiency of the appliance as used in practice, it is desirable that the experiments should be made under conditions similar to those in which the appliance is actually used, but unfortunately this is, in the nature of things, impossible. No reliable figures could be obtained while the apparatus was in use in cooking an actual article of food, because the amount of heat transmitted to such material cannot be measured, and also because of the extreme variations which arise in all the observable physical magnitudes during such an operation. Thus it is impossible to say when two similar joints are cooked to the same degree. It is, therefore, essential that the object heated for test purposes should be very different from an article of food, and such that the heat communicated to it should be capable of exact measurement.

Another difficulty in testing cooking ranges and the like is the question of "residual heat." The heat capacity of any cooking range is considerable; when put into operation the structure at first absorbs a large proportion of the heat generated, which remains after the useful operations are discontinued, and is only gradually dissipated thereafter. In making calculations from the results of a given test, this "residual heat" cannot be ignored unless the cooking operations have been continuous and uniformly conducted throughout, but in ordinary practice the apparatus is rarely used in such a continuous manner. And as such "residual heat" is usually much larger in amount than the total quantity utilised, it is evident that the efficiency cannot fail to be low in any practical case, and will vary greatly according to the weight of the appliance and the length and extent of the cooking operations.

The determination of any true efficiency can only be made by raising the apparatus to, and maintaining it in, a "steady state" as nearly as possible, during which period valid observations on running efficiency can be made. It is, therefore, necessary to maintain the temperature as constant as possible over a long period in the steady state, and to integrate the entire results over a period of many hours.

The numerical results obtained during my experiments have in all cases been verified by the subsequent use of the same appliance in cooking a standard weighed menu, and there has been found to be a reasonably close correspondence between the fuel consumed during the practical operations and the figures experimentally determined.

The four principal sources of heat usable in cooking ranges are solid fuel, gas, electrical energy, and oil fuel. Fairly complete investigations have been made of solid fuel and gas, but the electrical series are in progress at the time of writing, and cannot be spoken of with the same degree of confidence as in the other two cases. The oil methods have not been investigated at all.

Of these four, solid fuel is by far the most difficult to handle in an experimental sense. It is impossible to measure the instantaneous rate of combustion. This cannot by any means hitherto discovered be maintained as constant as is necessary for really accurate instantaneous observations, and to maintain a true "steady state" in which the temperature of the range itself is kept accurately constant from hour to hour is not possible. Results can only be obtained by prolonging the experiment and obtaining a final result by a process of integration.

When a charge, however small, of fresh solid fuel is added to a glowing fire, the resulting combustion is essentially variable. When the rate of stoking is maintained artificially uniform, this variation of the reading takes the form of cyclical variations only approximately of sine character. Another considerable difficulty relates to the intensity of the draught. The same total rate of combustion can be produced in a variety of different ways by varying simultaneously the thickness of the fire and the intensity of the draught. Each such combustion results in a variation in the observed result.

The measure of the combustion is effected by analysing the flue gases. It was found impossible, with a range as ordinarily constructed, to obtain any such value of the $CO_2$ content of the flue gases as would correspond to really efficient operations with the ordinary commercial type of range. The general value showed that from eight to ten times the chemically necessary minimum of air was used. A high $CO_2$ value can only be secured by artificially suppressing the in-leakage of air. The value of the $CO_2$ content in any given appliance was found to be a correct measure of the efficiency.

With gas there are similar difficulties with regard to the surplus air, but not with regard to constancy of condition. With electricity there are no experimental difficulties, provided that the voltage of the supply *is* maintained constant.

#### *Experimental Method.*

*Oven.*—The interior temperature in an oven is a function whose significance is very small, for the following reasons: (1) the reading of the same thermometer in different parts of the oven varies widely; (2) several thermometers of different type, all correct, and all, therefore, reading the same, when immersed, for instance, in hot oil, take up widely different readings when placed together in the same oven, essentially because the temperature of any object placed in any conditions is such that the net time rate of gain or loss of heat is zero.

Heat is lost or gained by any such object by radiation and convection. The relative influence of these two in any given environment depends on the size, shape, and radiativity of the surface of the bulb. Apart from any question of dimensions, no measurements of efficiency by means of thermometer readings would, therefore, in any case be possible. There is, in fact, no such function as the "interior temperature," and the expression "mean interior temperature" is meaningless, except when its physical meaning is arbitrarily laid down. The only function to which this expression can reasonably be applied is the rate at which heat is transmitted to some extended object of conventional standard size, radiativity of surface and shape, placed in the oven, and of such size as to occupy a large part of the space. The expression "efficiency" can only have a definite meaning when the object to which heat is communicated is precisely defined in these respects.

Exhaustive trials were made with vessels of standard shape filled with water, by observing the rate of rise of temperature, and calculating the transmission therefrom. This general method has the fatal disadvantage that great experimental difficulties are introduced, and with a large object in the oven having a rising temperature no sort of "steady state" can possibly be maintained. The efficiency also varies considerably according to the temperature of the object to which heat is communicated.

A more convenient calorimeter is a coil of blackened copper pipe, through which a uniform stream of water is maintained. Special devices were designed and made for maintaining constancy in the water flow. The water may be at any temperature for which the efficiency is required. The flow is regulated so that the rise in temperature between in-flow and out-flow is not great. The coil as a whole can be maintained at a constant mean temperature. This method has the great experimental advantage that one reading of the difference in temperature between in-flow and out-flow suffices to give the current rate of transmission, and the current variations in the thermal condition of the oven can, therefore, be determined.

The observed efficiency varies according to the temperature at which the coil is maintained. It is, therefore, necessary to lay down an arbitrary temperature at which all observations shall be made. If that temperature is high the resultant efficiency falls so low at low rates of combustion—even in extreme cases to zero—that its value cannot be accurately determined. As it is necessary to obtain a curve of efficiencies at all rates of combustion, it is, therefore, necessary to keep the mean temperature of the coil low, so that low rates of combustion may be included in the observations.

The temperature of the coil is of very great importance in the case of an ordinary gas oven. Where the temperature is low it enables the total heat of combustion to be brought into account; whereas when it is high the net heat only is available.

The use of gas enables much more accurate observations to be made, as a close approximation of the steady state is easily attainable by careful regulation of the rate of combustion. The latter can be controlled in the case of an oven so that any desired rate of transmission is maintained. In this case the principal difficulty is to determine how to deal with the difference between the gross and the net calorific value of the gas.

With a cold coil in the oven, a considerable part of the latent heat in the water vapour in the products of combustion may be communicated to the coil. The water appears as condensation on the surface of the coil, and drips down into the base. Thus obviously a portion of the latent heat is utilised. When the temperature is high there is no such condensation, and therefore no utilisation of this fraction of the heat of combustion. Whether and to what extent this latent heat is utilised in the actual cooking of an article of food it is impossible to say—probably some portion in the earlier stages, and after a re-evaporation of the same water originally condensed.

It will be evident that the efficiency as observed with this coil calorimeter will vary according to the surface area of the coil, or, what is the same thing, according to the size of the oven in which the coil is placed.

In order to compare, on a rational basis, ovens of different size it was necessary to investigate the question

* Fifth report of the Fuel Economy Committee, presented to Section B, Chemistry, British Association, Hull meeting, 1922.

† No. II. appeared October 6th.

of the variation of apparent efficiency according to the size of coil used, and to specify the standard loading for an oven of any given size. It was found that when an oven is loaded to its fullest practical capacity the surface of all the food is approximately half the surface of the oven plates. This was, therefore, laid down as the standard loading.

The final efficiency therefore determined upon was the ratio between (1) the heat communicated to a coil whose exterior surface was half the interior surface of the oven when kept at a constant temperature, and (2) the amount of heat in the quantity of standard fuel burnt per hour. This function varies according to the rate of combustion, the efficiency increasing with increasing combustion. Its value was determined for three different rates, and a curve drawn through the three experimental points so obtained.

*Hot Plate.*—The efficiency in this case is the ratio of the maximum hourly amount of heat which can be communicated by the hot plate to ordinary cooking vessels to that in the fuel consumed per hour. This efficiency is fairly constant at all rates of combustion. The hot plate is covered with standard cooking vessels, each containing a weighed quantity of water, the rate of rise in which is determined.

*Hot-Water Supply.*—This efficiency is the ratio between the heat communicated to the water in a weighed and measured cylinder and that in the fuel consumed. 20 lb. of fuel are used for this test.

### Summary of Results.

The following table gives a summary of the usual values obtained by the methods outlined in the foregoing Appendix. It is to be understood that the phrase "commercial" means a range or appliance as supplied by makers and used in an ordinary manner, and that the term "specially designed" refers to appliances designed by me for these tests which, though expensive in construction, are thoroughly practical in character.

#### Solid Fuel Appliances.

| | Found efficiency. Per cent. |
|---|---|
| *Oven.* | |
| Highest value with specially designed range .. | 9.5 |
| High values with commercial ranges, from .. | 4.0 to 5.0 |
| Usual values with commercial ranges, from .. | 2.0 to 3.0 |
| Lowest value with commercial range .. .. | 0.8 |
| *Hot-Water Supply.* | |
| Highest value with specially designed semi-independently fired boiler .. .. .. .. | 42.0 |
| High values with commercial appliances, from | 15.0 to 20.0 |
| Usual values with commercial appliances, from | 8.0 to 15.0 |
| Lowest value with commercial appliance .. | 4.8 |
| *Hot Plate.* | |
| Highest value with specially designed appliance | 21.0 |
| High values with commercial appliances, from | 4.0 to 12.0 |
| Usual values with commercial appliances, from | 2.5 to 5.0 |
| Lowest value with commercial appliance .. .. | 1.14 |

#### Gas Appliances.

| | |
|---|---|
| *Oven.* | |
| Highest value with specially designed oven .. | 55.0 |
| Highest value with commercial oven .. .. .. | 38.0 |
| Lowest value with commercial oven .. .. .. | 17.0 |
| *Hot Plate.* | |
| Highest value with specially designed appliance | 60.0 |
| Highest value with commercial appliance .. | 55.0 |
| Lowest value with commercial appliance (old pattern) .. .. .. .. .. .. .. .. .. | 17.0 |
| *Griller alone (excluding boiling vessel standing over griller).* | |
| Highest value with commercial appliance .. | 19.0 |
| Lowest value with commercial appliance .. | 10.0 |

A. H. Barker.

## A New Marine Motor.

In a leading article on marine motor design given in our issue of September 8th it was remarked that since the war there had been a marked decrease in the demand for expensive marine motors, and that much of the trade of to-day was done with engines of comparatively low power. Such engines are usually manufactured under conditions which make for the rapid construction of a large number of units of the same size and type, resulting in a corresponding decrease in the cost of both the engine and its spare parts. An interesting example of a neat and well constructed marine motor of this type is the new 10 horse-power four-cylinder marine set recently introduced by the Aster Engineering Company (1913), Limited, of Wembley, Middlesex, which we illustrate in the accompanying engravings. The general view of the set, given in Fig. 1, shows the arrangement of the combined engine and reversing gear. The engine is characterised by its cleanness of line and the magneto and carburetter controls are conveniently grouped on the vertical hand starting pillar on the reversing gear casing. This casing completely encloses the clutch, brake and epicyclic reversing gear, a section of which is reproduced in Fig. 2. It will be noted that the hand starting mechanism is of the self-releasing type. The clutch and reversing gear are operated by a single lever control, giving, by means of a slotted link, ahead, astern, and neutral positions. In Fig. 2 a vertical section through the engine is given which shows the removable monobloc cylinder cover and the combined cylinder casing and crank case casting, which parts are made in cast iron. The cylinder cover is cored in such a manner that the inlet and exhaust passages are self-contained, and the usual manifolds are thereby eliminated, the carburetter being attached to the side of the cover and the exhaust pipe connected at the end of the engine immediately above the fly-wheel casing. The valve mechanism is of the push-rod type, and is made easily accessible by removing the light aluminium cover. An inspection door on the cylinder casing also provides access to the tappets and the cam shaft. This shaft, together with the magneto, is driven by a silent chain of the inverted

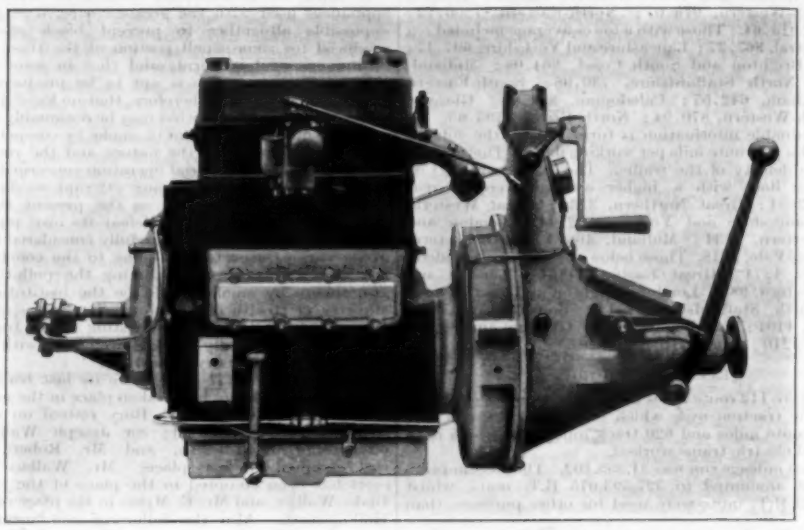


FIG. 1—THE ASTER 10 HORSE-POWER MARINE ENGINE

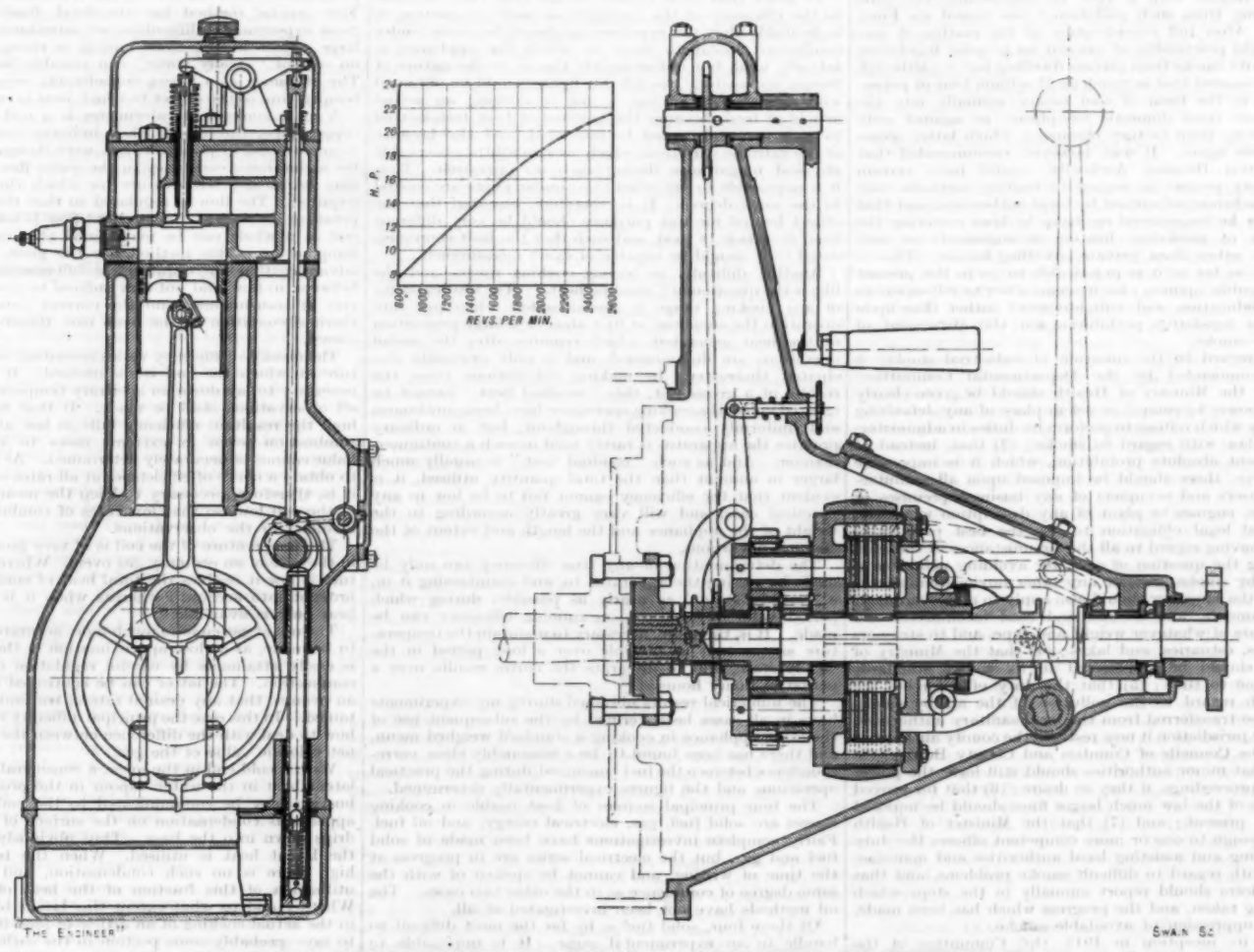



FIG. 2—VERTICAL SECTIONS THROUGH THE ASTER 10-H.P. MARINE ENGINE AND REVERSING GEAR

tooth type, which is completely enclosed in an oil-tight casing, and means for adjusting the chain are provided. A bracket fixed at the forward end of the engine carries the rotary circulating water pump, which is also driven from the cam shaft. The engine is lubricated on the trough system, the desired level of oil being maintained by an oil pump driven directly from the cam shaft and arranged in the lower part of the crank casing in such a way that oil is drawn from the bottom of the engine sump, which is attached to the underside of the main crank case. The crank shaft is of robust construction, and both the main and bottom end bearings are fitted with white metal-lined bearing brasses. Light aluminium pistons are used, which are of a patented construction, and are fitted with a "non-slap" device. Having a cylinder bore of 65 mm. and a stroke of 110 mm., the engine develops its rated output of 10 horse-power at a speed of 1200 revolutions per minute. The engine is furnished with a governor, and its performance is illustrated by the power and speed curve included in Fig. 2.

## Provincial Letters.

### THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

**The Miners' New Agitation.**

The quarterly meeting to-day—Thursday—in Birmingham was considerably affected by the new miners' agitation, for while it is not anticipated that the Prime Minister will give the men much satisfaction, it is feared that serious developments may follow. The keynote of the miners' manifesto would appear to be found in the declaration that it is impossible to resist the existing conditions much longer. It is claimed that in some districts, including South Staffordshire, the vast majority of the miners are receiving an income 40 per cent. and more below the standard of living. While the miners demand an increase of pit-head prices as a means of reducing production costs and enabling the employers to pay them enhanced wages, the owners plead for the consumer. It was emphasised on 'Change to-day that an increase in pit-head prices would so raise the charges to consumers that big coal-consuming industries would have no chance to reconstruct their trade. Consequently, the new agitation was regarded here to-day as a menace to any trade revival, and was on all sides seriously deplored. It is considered in some quarters that the men are again pursuing a policy of grasping, and have learned nothing from the incalculable injury which they inflicted by the last strike, not only upon the iron and steel trades, but upon every industry in the country. Remembering how the Prime Minister has given way to the miners on previous occasions, the market here to-day was not a little anxious concerning the probable character and outcome of the coming interview at Downing-street.

**Birmingham Quarterly Meeting.**

The quarterly meeting at Birmingham to-day—Thursday—attracted a large attendance drawn from all parts of the country. As was expected, the volume of business passing was on the small side, and though reports from the different centres were far from bright, there was a disposition to take a more hopeful view of prospects in general. True, the stimulus which the autumn was expected to impart to the iron and steel trades of the Midlands and Staffordshire has so far turned out to be fitful. Works in this area are getting only comparatively small orders, and those come to hand irregularly, so that plants are kept going for a few days and then they come to a standstill for probably an indefinite period. The Black Country is suffering more severely than some other parts of the district, owing to the severe blow which the local pig iron industry has sustained. With production costs disproportionately increased by the railway rates, idle South Staffordshire furnaces have no chance of re-starting. Smelters have little to encourage them to re-commission their furnaces, even if the disparity in production costs could be overcome. Additional competitors for business could only succeed at the cost of those who are already supplying the market, so that the contingency of a further cut in prices cannot be excluded from the calculations of furnace owners, who are anxious to see unemployed plants going again. At the moment, the output of pig iron is in excess of the current requirements. The position of the bar iron trade is also disappointing, and more mills in this district are being brought to a standstill for want of orders. In the past week or two, there has been less activity in the local bar iron mills than during July and August, and certain works have not operated more than one week during the past month. A number of the mills, however, have been able to get business in the way of re-rolling steel. The iron trade is suffering much in competition with steel. Mild steel is rapidly extending its use in competition with dearer iron. Ironmasters regard as a rather hopeful sign the number of inquiries being received for railway rolling stock. It is strongly hoped that these will materialise early, and will result in business with the Staffordshire mills. Several branches of the iron trade also expect to benefit from the revival of house building, which appears to be a general experience throughout the district. Ironmasters who specialise in unmarked bars suitable for the nut and bolt industry are finding business more difficult to secure each day. The diversion of business to Belgium has been more pronounced of late. Buyers are making use of the foreign market, with its depreciating exchange, to level down prices at home. To what extent they will succeed depends upon the volume of the business offered. British mills could turn out bars cheaper if their turnover was large, but makers are not anxious to cut the price immoderately, even in face of foreign aggression, to exploit an unresponsive demand.

**Bar Iron Situation.**

Demand for marked bars shows no expansion. While unmarked bars have receded, up to the time of writing the list houses who do not consider business worth having on prevailing lines at less than the old £13 10s. standard, have made no price alteration. Crown bars of sound quality do not command more than £11 to-day, and buyers who are satisfied with a lower grade can be accommodated at £10 10s. Nut and bolt bar houses, which until recently were refusing to entertain less than £9 17s. 6d., are now glad to get orders of any respectable size at £9 15s. They still adhere to their quotation of £9 17s. 6d., but do not now let business slip if they can get the lower figure. A few lots of 50 tons and upwards have been sold this week. Nut and bolt manufacturers are still short of work, and under these circumstances prefer as a rule to satisfy current requirements by hand-to-mouth buying. Belgian shippers who are prepared to send No. 3 bars over at £8 7s. 6d. are securing a larger proportion of the business than local makers like. Generally speaking, quotations range rather higher than the figure mentioned, and the interval between the giving of an order and its fulfilment is a considerable disadvantage to buyers, who can only see a short distance ahead. Some steel re-rolling concerns have booked good lines which will keep them busy for a few weeks. Some of the sheet rolling works have derived a little benefit from the improvement in the motor industry. The depression in the iron trade has once more given steel a decided lead over iron, owing to its greater cheapness. Steel gas strip, for example, can be bought at from £8 17s. 6d. to £9, as compared with £10 15s. to £11 for iron. The undercutting that has been prevalent in the iron strip branch has been under consideration by associated manufacturers, and assurances have been exchanged which, it is hoped, will help to consolidate a difficult position.

**Galvanised Sheet Trade.**

The galvanised sheet trade is better again, mills being fairly busy at recent quotations. Inquiries received this week have led to business with the West Indies, and some good contracts are in the market with India. Strong belief was expressed on 'Change that the sheet trade and tin-plate trade will benefit considerably, if the hopes of a pacific settlement of political troubles are realised. During the past few days inquiries have been on the increase.

**Pig Iron.**

Pig iron orders are strictly for immediate requirements, and stocks in consumers' hands are so small that delivery is frequently asked for within twenty-four hours of the placing of the order. The continuance of the export business with America has helped certain Midland firms, most of the few furnaces in operation having been offered a certain proportion of American business. A very large offer from America was received this last week by a Staffordshire firm, but as it was contingent upon delivery this month, the business was beyond the capacity of the furnace in question. Midland smelters have derived some benefit from sales of pig iron into North-Eastern districts, in competition with Cleveland, where prices have been enhanced by American buying. Smelters in this district are not as a rule able to get any better price against the increased demands for coke. Foundry irons generally rule at 80s. for Northamptonshire No. 3, 82s. 6d. for Derbyshire, and 84s. for North Staffordshire at furnaces. For forge qualities prices range from 70s. to 72s. 6d.

**Steel.**

The position of steel is not altered essentially. There is a rather better feeling regarding structural material, otherwise the enervation continues. Angles are £8 15s.; joists, £9; ship, bridge and tank plates, £9 10s.; boiler plates, £13; bars, £8 17s. 6d. to £9 2s. 6d.; hoops, £11 10s. Little is heard of foreign competition in semi-finished steel. France and Belgium, it is reported here, have found it possible to start several furnaces, and their foreign bookings generally have enabled them to quote somewhat higher prices in this market. Belgian semi-steel offers practically no advantage in the way of price to British buyers, the home price being about £7, while the Belgians are asking £6 17s. 6d. for billets delivered in Birmingham. Wire makers are complaining of increased competition from German makers, who are underselling them.

**Engineering.**

Constructional engineers in the Midlands are decidedly busier on moderate contracts for erections and extensions, though it is regretted the widening inquiry for structural steel is not bringing much business forward. The Midlands must be less fortunate than other parts of the country, for even those departments of industry which are most nearly concerned with the great engineering schemes that are being launched in different parts of the world do not as yet display more than sporadic activity. This would seem to indicate that the multitude of small orders which it was hoped would have been released as costs were lowered is still being withheld.

### LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER, Thursday.

**Iron, Steel and Metals.**

The general condition of the iron and metal markets here is very dull, although here and there one notices a cheerful individual who has managed to do some business. As, however, one swallow does not make a summer, so one transaction does not make a market, and it is as well to discount the optimistic views of those who may have chanced to do well during the week. The volume of business all round is certainly very small, and the utter absence of any speculative energy is apparent. Probably this is a good reason why the markets seem to be so dull; for there is no doubt that speculation tends to brighten up a market very considerably even in the absence of sober business. The scope for the speculator, however, is just now very limited, for the consumer is not to be tempted to buy far ahead, and it is no use to make a speculative sale for delivery next week.

**Metals.**

The demand for copper here is rather poor in all departments of the market. Manufacturers are a little disgusted that they should be asked to pay another £2 per ton for copper sheets, the price of which was already far higher than could be justified by the cost of production. With English refined ingot copper at £66 per ton it does seem absurd to want £96 for rolling into sheets. It is quite amusing to look at the three costs of sheet rolling in the metal trade: Zinc sheets cost £5 per ton to roll; lead sheets, £10 10s. to £11 per ton; and copper sheets, £30 per ton. Of course, the amusement is on the side of the lead and copper manufacturers, and corresponding chagrin is felt by the zinc rollers and the consumers of lead and copper. Electrolytic ingot copper remains at from £4 to £5 per ton above the price of English ingots, part of this difference being caused by the state of the American Exchange. It seems to be thought that sterling will depreciate still further in terms of dollars; and if so, it seems likely that the differences between these two classes of copper will be maintained for a time. After the the end of the year, however, it is probable that the tendency of the exchange will be the other way, for eventually we shall have to get back to a gold standard of currency in this country. Meantime it is probable that copper prices will remain fairly stable, for there is no indication at present of any decided movement one way or the other. The demand for tin is quiet and without any special feature. The visible supply is rather less than a month ago, but the difference is only about 5 per cent. Apparently the supplies of tin coming into the market are quite sufficient to meet all requirements, and while this is the case it is difficult to see why any serious change in the market should take place. When there is no reserve stock in any market it is possible to have rapid changes in price with a very slight difference between the supplies and the consumption; but in the case of tin there is now a large reserve stock in the East, and this is bound to have a steadying effect on market fluctuations. Lead has again been a very firm market, and we are still in doubt as to whether or not the new American tariff will divert much Mexican lead to this country. If it does we may see a set-back; but at the moment the tendency is to increase in the consumption of lead, while supplies from Spain and Australia are limited. Some people are saying that lead ought to be nearer the price of spelter, but this is not at all the natural position for the metal. The supplies of spelter have again been small, Germany offering nothing and Belgium only a little. The price has therefore again been better and the market has a strong appearance. Spelter is now dearer than it has been since December, 1920.

**Pig Iron.**

The market in Manchester for foundry iron is quiet and steady, and there does not seem to be any indication of change. It now seems probable that Derbyshire pig iron, which is the only make of foundry pig which now appeals to Manchester, will remain at about 90s. per ton delivered during the remainder of the year. Consumers here are disposed to buy on these terms for delivery over the next two months, but there is not yet any disposition to make contracts into the New Year. It is thought that by the end of this year the effect of the American purchase will have passed off, and then, if there be no improvement in the general ironfoundry trade, there should be plenty of foundry iron for all requirements, and perhaps the chance of lower prices. The demand here for Cleveland and for Scotch pig iron is in abeyance, because of the extravagant prices. Sellers of Scotch iron are a little easier than they were, but the price asked is still about 35s. per ton more than the cost of common iron, and consumers are simply postponing any buying until more moderate conditions prevail. There is now some interest taken by the Manchester ironfounder in East Coast hematitie pig iron, which can be bought, delivered in Manchester, at about 107s. per ton.

**Steel.**

The demand for finished steel is said to be a little better than it was, but as a rule the prices are unchanged, although here and there one finds an attempt to put them up a little. Export business is said to be more plentiful, and there is certainly more inquiry, but this does not touch Manchester very closely.

**Scrap.**

Dealers complain very much of a lack of demand for scrap of all kinds. The Lancashire ironworks are still offering only 65s. per ton for heavy wrought scrap, and it scarcely pays the dealer to work at such a price. Ironfounders are buying very little cast scrap at present, and will pay only low prices for it. Thus good machinery scrap which in normal times was worth fully as much as No. 3 pig iron, is now selling in Lancashire at 10s. per ton less.

**Municipal Technical Library.**

A private view of the new technical and science library which is the latest development of the Libraries Committee of the Manchester Corporation, was held on Friday last. The public libraries of the city have, of course, always contained a collection of technical books which have been regularly augmented by the most recent standard works, but engineers and other men of science have for a long time felt the need of a really comprehensive central library which would compare with, say, the Patent Office Library in London. In 1919, the Libraries Committee formed the Commercial Library in response to the demand of the business community. It is situated in the Royal Exchange building, and has proved an unqualified success, being visited by over 400 readers per day. The technical library now open will fill, in a large measure, the requirements of engineers and others. The keynote of the collection is "system." Minute classification, open shelves, extended cataloguing and indexing,

facilities for reading, and a special staff are the pronounced features. The subjects represented include natural science, mathematics, astronomy, physics, chemistry, geology, palæontology, biology, botany, zoology, useful arts, medicine, engineering, agriculture, domestic economy, communications, chemical technology, manufactures, mechanic trades, building, and British, United States, and colonial patent specifications. The library is by no means so rich in technical periodicals—especially foreign publications—as it should be, and means are being considered whereby the collection may be augmented in the future, possibly in part by some working arrangement with the technical and scientific societies in the city, which have already shown their interest in the development of the library. The regulations for the use of the library are few and simple. The visitor signs his name and address in the visitors' book on entering. For the books on the open shelves no further formality is required; for the patents and for books in the main reference library the usual readers' tickets must be filled up and handed to the attendants. The library cannot fail to prove a boon to students, and it is to be hoped that a more suitable building will shortly be provided.

BARROW-IN-FURNESS, Thursday.

**Hematite.**

There is a brighter feeling in the hematite pig iron trade, and it is quite an established fact that makers generally view the position with confidence. It is not wise to be too optimistic, but everything points to better trade. It will come gradually, but not as slowly as was at one time feared. It is quite evident that engineers and others are becoming busier, for their orders and inquiries are for greater bulk. More furnaces will have to be put in blast if the demand increases. There was a dark cloud on the labour horizon which threatened to darken the early future, but negotiations of a commonsense character have taken place, and everything points to a settlement without a stoppage. The making of special quality iron is on the increase, for engineers are now in need of it. The continental business promises to be better, and the dispatch of pig iron to the States continues. Last week saw cargoes of pig iron leave this port for Liverpool (for transhipment), Baltimore, Glasgow and South Wales.

**Iron Ore.**

The iron ore trade is improving, and will continue to do so in view of the increase in the number of furnaces in blast; but trouble threatens with the miners, who are dissatisfied with their wages. Negotiations are taking place, and it is hoped that the matter will be got over without a stoppage. There is little foreign ore coming in, but large stocks exist at the docks, and these will be reduced first before there are more heavy imports.

**Steel.**

The steel trade is brighter, and the Workington rail mills are again at work. The Barrow rail, merchant, and hoop mills are still engaged and are taking a large quantity of iron made at Barrow. The foundries are moderately employed.

## SHEFFIELD.

*(From our own Correspondent.)*

**Improvement in the Heavy Trades.**

THE steel trade continues to show signs of revival, even though very slowly. Opinion is now fairly general that the worst of the depression has been seen, and that an improvemept has set in. This is now showing itself in the heavy branches, which are of prime importance in the amount of work they are capable of providing, but which have been among the most stagnant of all for a considerable time. Armament work does not come forward, the British Government still withholding the orders for the two new battleships. The action of the Prime Minister recently in refusing to receive a deputation of the Lord Mayors and Mayors of Sheffield and other towns on the subject of unemployment, and the serious consequences of delaying these orders, has aroused much indignation in the city, and the City Council has this week passed a strong resolution of dissatisfaction, coupled with a hope that further efforts will be made to press the Government to put the work in hand forthwith. With regard to shipbuilding generally, the position is better. Several Sheffield firms either have shipyards of their own on the coast, or are associated with shipbuilding companies, and orders which have recently been placed at Belfast, Clydebank, and Birkenhead will bring welcome work for steel plates. There is an improved feeling, too, in the railway steel branches. India has sent some orders along, and has inquiries out for a considerable quantity of supplies, five locomotives being among them, while the prospects of larger business from the home railway companies are becoming brighter. Sheffield will also benefit by the useful engineering orders which have lately been secured by Lincoln and other firms, as castings and forgings from this city are sure to be wanted. It is reported, by the way, that Ruston and Hornsby, of Lincoln, have practically secured another important contract, but details are not yet available.

**September Shows Progress.**

The improvement in trade is not of an all-round character. There is no advance in the crucible steel trade. Makers were looking for a turn of the tide in August, but many of them have found that their trade in September was as bad as during any month since the war came to an end. The passing of the Fordney tariff was a severe blow to this trade, but Mr. Peter MacGregor, one of the leading manufacturers, has pointed out that a substantial point was gained in getting rid of the American valuation for tariff, and he did not think that the new measure was going to operate as seriously against Sheffield as had been feared. Against the prevailing slackness of the crucible and high-speed steel departments may be set the fact that there is a better request for special steels, which has led to the re-starting of electric melting furnaces, some of which have been idle for as long as three years. While orders for acid steel are few, a fair amount of business is being obtained for basic billets, common spring steel, and strip. A good deal of this trade is on export account. There is an improvement in colonial ordering, and trade with Russia is more active. On the whole, the general opinion is that the month of September showed an improvement, slight but definite, on its immediate predecessor.

**Light Trades Doing Well.**

A remarkable and very welcome change has come over the silver and electro-plate trades during the last couple of months. From being only half employed, except in one or two departments, they have now become very active. This relates especially to electro-plate, makers of which have booked a large amount of business for delivery in time for the Christmas sales. A Christmas season spurt in the demand is a standard feature of this trade, but last year it was entirely missing, and the stagnation of trade continued until a few weeks ago. This autumn, however, conditions resembling those of old times are again prevalent. Australia and Canada are buying well, and shopkeepers at home are sending in orders which, though individually on the small side, are numerous, and sufficient in general bulk to provide a large amount of employment. The demand for spoons and forks, which has kept up very well while other branches of trade have been languishing, is still maintained, and the number of these articles turned out is enormous. The improvement in trade extends to silver ware, and there is a good demand for cased goods. The cutlery trade cannot boast of equal progress, but it also is better. There is a capital demand for table knives, especially of the stainless variety, and a larger amount of business is being booked in some of the other branches which have been very badly employed for a long time. The lock-out in the pen and pocket knife departments continues, and affects the trade generally with the exception of three works, so that production in this branch is only on a limited scale.

**Contracts for Municipal Requirements**

A good deal of work of an engineering character is either being placed by municipal bodies in the district, or is in contemplation. The Sheffield City Council, for example, is buying 650 tons of tram rails from Steel, Peech, and Tozer, Limited, of Rotherham, at £10 5s. 6d. per ton. The Hull Corporation is in the market for 1000 tons of tram rails, but whether the order for this material will also come to Sheffield remains to be seen. Steel, Peech, and Tozer quoted £11 5s. per ton, but there were two lower tenders—one from the Equipment and Engineering Company, Limited, London, for rails manufactured at the Phœnix Works, Germany, at £9 8s. 6d. per ton, and the other from the Société Anonyme d'Acieres d'Angleur, Liége, at £10 15s. The Hull Tramways Committee has invited the Sheffield firm to reduce its tender, with a view to keeping the work in this country. Chesterfield Town Council has a scheme for boring for water, which will cost £66,798, and will provide a million gallons per day. It has applied to the Ministry of Health to sanction a loan. The proposed works are in two parts, but one of them, which is estimated to cost £25,000, may be postponed. At the Town Council meeting last week, the Mayor stated that boring would be much more effective and economical than reservoirs. The cost of the latter would have been £350,000, and the water supply only half as large. At Burton, the Town Council is proposing to widen the Trent Bridge at a cost of £71,680. The scheme provides for four lines of traffic, the doubling of the tram track, and two wider footpaths. The installation of a new refuse destructor, to cost £5000, is proposed by the Grantham Town Council.

**Ex-Master Cutler's Death.**

Mr. Marmaduke Wardlow, who was Master Cutler of Sheffield last year, survived the termination of his year of office by a few days only. He had been ill for some weeks, and died on October 5th, at the age of fifty-eight. He was proprietor of S. and C. Wardlow, of Portobello Steel Works, Sheffield, and Congress Works, Oughtibridge, a firm which has a high reputation for steel, especially cutlery steel, not only in this country, but also in America and on the Continent.

**Company News.**

The company news of the week has been of a varied character—some moderately good, and some bad. The brightest item is that afforded by the annual meeting of the United Steel Companies, which, despite the fact that no dividend could be declared, was of a cheerful character. The chairman was able to show that, but for the writing down of stocks and the maintenance of idle plant, a surplus would have remained after the year's working. His most pleasing statement was that July and August were better months than they had had for some time, and that the improvement, although not great, was sufficient to make the directors hopeful. He emphasised the fact, however, that if the better trade that is looming ahead is to be secured, there must be a substantial reduction of the crippling railway rates, and imperial and local rates and taxes. The shareholders of the Tinsley Rolling Mills had a disappointment when they received their annual report, showing a loss of £8650 on the year and no dividend on the ordinary shares. Last year 10 per cent. was paid, and the previous year 12½. The directors speak of the conditions of trade during the twelve months ended June 30th as having been without precedent, but they add the hopeful remark that since July 1st there has been some improvement. The sensation of the week has been the appointment of Sir William B. Peat as receiver and manager on behalf of the debenture holders of Sheffield Steel Products, Limited, a concern formed about the end of the war period, by the amalgamation of a number of businesses, with a capital of £4,000,000. The issued capital consists of £1,750,700 in ordinary shares, and £721,001 10 per cent. cumulative preference shares. The company secured an extensive munition works at Templeborough, where it carried on business on a large scale, but there have lately been many reports as to its unprosperous condition, and last week the price of the ordinary shares went down to a shilling. The secretary in a circular to the shareholders states that the report of the accountants appointed by the directors "discloses such a deficiency that the company has been advised that it cannot continue its business without reconstruction, with a view to securing, if possible, necessary further working capital. . . . With the assistance of Sir William Peat, the company hopes to formulate proposals for reconstruction which will be submitted to you for consideration in due course."

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

**A Serious Factor.**

THE alarming rise in the cost of fuel is a most serious factor in the situation of the iron and steel trade, and has caused a good deal of apprehension as to the future outlook. The Durham coke makers are now quoting from 30s. to 31s. per ton for good medium blast-furnace coke delivered at the works, and this means an addition of 4s. to 5s. per ton to the cost of pig iron production. Such an advance wipes out at one stroke all the smaller economies which, by dint of much sacrifice, the ironmasters have been able to effect, and it renders the prospect of any cut in the present selling prices exceedingly remote. Moreover, high prices react upon the demand, and so we see in dearer fuel a barrier against trade revival.

**Cleveland Iron Trade.**

The Cleveland pig iron market maintains a strong tone. There is still an active demand from America even up to December delivery, and makers are well sold. The higher prices now prevailing, however, restrict the continental demand, whilst even from many of the home markets Cleveland iron is shut out. The producers in this district are being heavily undersold by the Midland ironmasters, and merchants are becoming seriously alarmed about the loss of old clients, who, by reason of the high price of Cleveland iron, are going elsewhere for supplies. There has been no further advance, but all Cleveland prices are firm, and some of the makers have sold practically the whole of their make for October. No. 1 and siliceous iron are quoted at 97s. 6d. per ton, No. 3 G.M.B. Cleveland 92s. 6d. to 95s., No. 4 foundry 90s., and No. 4 forge 85s.

**Hematite Pig Iron.**

The position in the East Coast hematite pig iron trade has improved considerably. American consumers have been buying very freely, upwards of 10,000 tons having been sold for shipment to the United States during the past week. Its cheapness has attracted other customers, and sales have been so heavy that it is now difficult to buy for October delivery. Mixed numbers are round about 92s. per ton, and some makers quote 92s. 6d. per ton.

**Iron-making Materials.**

Holders of stocks of foreign ore are becoming increasingly anxious to sell, and this has a weakening influence on the market. Thus business in best Rubio ore is now possible at 23s. to 23s. 6d. per ton c.i.f. Tees. Good Mediterranean ores are still cheaper.

**Manufactured Iron and Steel.**

Little or no improvement is reported in the manufactured iron and steel trade. There are more hopeful views expressed, but these are not translated into actual business, and makers are still carrying on with small orders, which keep only a small portion of the plant employed. Prices are unchanged.

**The Coal Trade.**

The Northern coal market continues to be phenomenally strong all round, with really good prospects for a continuance of the present satisfactory situation for some time ahead. The collieries in both of the Northern counties are at present in a strong and unassailable position for bargaining, and are generally able to dictate their own terms. There is, of course, a large and growing output, but so far the demand has more than overtaken the supply, with the result that there is keen competition among buyers, who in these circumstances are often forced to concede better prices in order to effect the deliveries of their orders. Prompt business is only of limited dimensions for lack of supplies, and mostly in second hands at quite top figures, and in some cases even above the quotations, though direct from the collieries any odd lots available are snapped up instantly. The steam coal section continues very strong for any supplies of screened sorts, either bests or seconds, while for small steams there is an improving market. The Durham gas coal trade is very active, and several large contracts for Denmark, Sweden and France have been fixed up, shipments to be made up to the end of the year. Coking coals are almost unobtainable for any date this year, and are at top figures for any quantities on offer. The coke market is very firm for beehive or patent oven foundries, but in the case of gas coke there is a rather easier tone for every make.

**Blast-furnacemen's Wages Cut.**

A further reduction has been made in wages of blast-furnacemen employed at the ironworks on the North-East Coast. The ascertainment issued by the Ironmasters' Association certifies that the average net selling price of No. 3 Cleveland pig iron for the past quarter was 85s. 7.16d. per ton, a reduction of 2s. 4.48d. per ton as compared with the price for the previous quarter. Under the sliding scale arrangement, blast-furnacemen's wages are reduced by 2.25 per cent., which will bring the wages from 26.25 per cent. to 24 per cent. above the standard. The reduc-

tion takes effect from October 1st. Since the beginning of the year the wages of the blast-furnacemen on the North-East Coast have fallen from 170.25 per cent. above the standard to 24 per cent. above the standard. In other words, their earnings are less than half what they were during the boom.

## SCOTLAND.

*(From our own Correspondent.)*

### Better Outlook.

The orders recently placed for new shipping have created a feeling of hope with regard to the near future. Markets have been dull so long that few are inclined to indulge in optimistic opinions, but it is nevertheless apparent that this small shipbuilding movement has struck a cheerier note. The contracts placed cannot have a great effect on local industries, but at the same time indicate a step in the right direction and inspire the hope of further developments in a similar direction. Much will depend on the outcome of the deliberations on the question of wages. Amicable settlements in the shipbuilding and other industries will go a long way to establishing a confidence in the various markets, a feeling which is still sadly lacking.

### Probable Further Contracts.

Following the shipbuilding contracts already referred to come rumours of orders of a similar nature. It is reported that there is every probability of another order for a liner for the Union Steamship Company of New Zealand. Further, it is understood that many of the difficulties in the way of the contracts for ships for the Western Australian syndicate concerned with the frozen meat trade have been overcome, and it is expected that three of the steamers will be built on the Clyde. Two other tenders for fairly large vessels are also mentioned, while others are hinted at. Should the majority of these orders materialise a very welcome addition will be made to contracts already placed. It is also reported that work is to be commenced immediately on two vessels to be built at Scotstoun to the order of the Asiatic Steam Navigation Company. These vessels will be of 8500 tons deadweight each.

### Pig Iron.

Although with the falling away of American demands business in the Scotch pig iron trade is expected to slow down somewhat, business may improve on local account and compensate for the loss in export turnover. In the meantime the output is moving off freely and quotations are maintained at a firm level. Outputs will shortly be augmented by the output from furnaces recently re-started.

### Steel and Iron.

While firm orders for steel material are not yet of great dimensions, the inquiries in circulation seem to indicate the presence of considerable business. The shipbuilding orders may be of some assistance, but these are mostly for ships of the liner class, which, it is said, do not affect the works to the same extent as ships of the tramp class. At the moment the majority of the steel works have a large proportion of their plant unemployed. Orders for plates are especially slow and the business passing for sectional material, though a little better than formerly, leaves ample room for expansion. Sheet makers are still chiefly concerned in the production of light gauges for export and find great difficulty in securing anything on home account. The situation in the bar iron trade is unchanged. A number of orders are coming in from structural and wagon builders, but they provide little relief to the prevailing unemployment. Prices all over are unchanged, but in most cases terms could be arranged if a favourable specification was presented.

### Larger Inquiry for Coal.

While there is no undue demand for fuel, the coal market is firm in tone, and the collieries are moderately well placed for business at present. Best Lanarkshire splints have recorded a fair turnover for export, principally to Italian destinations, and second-class qualities also are doing comparatively well. Best ells, steams and navigations have booked some good lines, the latter at a figure round about 26s. per ton f.o.b. Washed nuts are moving off freely, good consignments going to German and Scandinavian ports. The Lothians and Fifeshire collieries are also largely interested in the export of washed fuels to the countries mentioned. Home demands are slow to improve. Only a limited business is passing in industrial sorts, while house coal is less active than usual at this season of the year. Aggregate shipments for the past week amounted to 355,659 tons, against 366,370 tons in the preceding week and 339,911 tons in the same week in 1913.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

### Coal Trade Outlook.

At the moment the outlook in the coal trade is less satisfactory on the labour side than from the point of view of the foreign demand. The application of the workmen's representatives for better wage conditions at the National Board meeting last week drew from the coalowners the reply that was expected, viz., that it could not be conceded, except in this respect that the coalowners intimated that they would have to consider at an early date the question whether the low wages at present being paid would not have to be further reduced by the abolition of the minimum of 20 per cent. above the pre-war wages. This rather savours of carrying the wages war into the camp of the miners, and in view of the strong feeling now prevailing on the part of the workmen, it certainly does not inspire confidence regarding future harmonious relations between the respective parties. In South Wales the position is rather aggravated by the trouble at the Ebbw Vale collieries and works, and unfortunately at the moment there is no sign of an immediate resumption of work, while, in addition, there is the non-unionist question and a dispute regarding the interpretation to be placed on the award of Lord Buxton respecting the subsistence wage to be paid to the lower-paid workmen.

### Lord Buxton's Award.

Shortly after Lord Buxton, the independent chairman of the Coal Conciliation Board, gave his award concerning the application of the miners for a subsistence wage for the lower-paid workmen, the secretary of the Coalowners' Association sent out a circular to the colliery companies giving them instructions for the application of the award. A copy was also sent to the workmen's representatives, who, on seeing its contents, intimated to the Coalowners' Association that they could not accept the interpretations placed on the award by the employers, and they requested the latter to make no payment to the workmen pending consideration of the matter by a joint committee of the owners' and workmen's representatives. The owners agreed to this request, and on Tuesday last the subject came up for discussion at a meeting of the Joint Standing Disputes Committee. The principal point in dispute concerns the lower-paid men engaged on the afternoon and night shifts. These men are paid six shifts for working five, and in order to ascertain their daily wage the owners contend that the total weekly earnings should be divided by five, the number of shifts actually worked. Upon this calculation, the daily wage works out at 7s. 8.1d., upon which no subsistence allowance is payable. On the other hand, the miners' representatives state that the total earnings should be divided by six, the number of shifts actually paid for, which gives a daily rate of 6s. 4.8d., which carries with it a subsistence allowance, making the daily wage up to a maximum of 7s. 2d. and 6s. 8d. for the two categories into which Lord Buxton divided the workmen. The coalowners and the workmen's representatives after a long discussion failed to agree, and it was therefore decided to refer the points in dispute to the independent chairman.

### Dock Charges.

The recent reductions in dock charges granted by the Great Western Railway Company have recently been discussed by the secretary of the South Wales Coalowners' Association. In pre-war days, he says, the cost of tipping and weighing coals amounted to 2½d. per ton; they were increased to 1s. 3d., and now stand at 9d. per ton. It will thus be seen that in this case the existing charge is 300 per cent. above the pre-war rate. In the second place, other local dock charges were increased to 150 per cent. above the pre-war level. In these other charges there have been reductions during the present year, but they are still 100 per cent. more than those of 1913. In the third place, non-statutory charges have been increased, in some cases by enormous percentages, while several new charges have been introduced and enforced. Indeed, in the case of one of these charges, the discontinuance of the service performed was threatened unless the charge was paid, and the carrying out of this threat would have led to the closing of collieries. Dealing with the financial aspect of the question, Mr. Gibson states that in 1913 the average monthly revenue from the weighing and shipment of coals was about £29,000. He arrives at this estimate by taking the quantity of coal shipped and basing the average charge at 1½d. per ton at Swansea and 2½d. at the other South Wales ports. The rate of 1s. 3d. per ton was fixed in September, 1920; in November, 1921, the rate was reduced to 1s. 1d.; in January, 1922, to 11d.; in June last to 10d.; and in the present month to 9d. During the whole of this period the volume of the export trade has been steadily expanding. In September, 1920, it was just over 2,000,000 tons; this year the lowest quantity shipped has been 2,305,000 tons, while in three out of the eight months ending last August the quantity exported has exceeded 2,800,000 tons. The effect has been that on this increased volume of trade the revenue from the shipping and weighing charges has amounted to no less than nearly £156,000. Even under the 10d. rate it amounted to £117,000 in August last, or about four times the average monthly revenue in 1913.

### Current Business.

During the past week business has been comparatively brisk, and all the collieries producing the better classes of coals are in a much stronger position than was expected a fortnight ago, as at that time order books were anything but well filled. The trouble in the Near East is largely responsible for the improvement, as the Admiralty has come into the market for supplies, and there has been quite a good deal of buying from Italy, due also to the Near East outlook. France, too, has been taking additional quantities, and altogether the conditions have been quite active. Admiralty coals are fully booked for the remainder of this month and dry coals are also tightly stemmed on account of sales arranged for the States and Canada. Best Admiralty large are firm at 27s. 6d. to 28s., and best dry large are scarce at 28s. to 28s. 6d. Monmouthshire qualities are not so brisk, and unfortunately inferior coals have not participated in the improvement, and can do with orders, although if the demand for the superior descriptions is maintained, it will ultimately be reflected in a better inquiry for the lower classes. Small coals are more plentiful than is desirable, and some colliery owners have the greatest difficulty in finding a regular outlet for them. The result is that they are prepared to make concessions to anyone who can relieve them of any substantial quantity, while some salesmen are refusing to sell large coals unless buyers are disposed to take a proportion of smalls. The patent fuel market is rather quiet, but coke is steady. In the authracite section, large coals are still on the easy side, but sized coals are rather scarce, and prices are well maintained.

## Latest News from the Provinces.

### WALES AND ADJOINING COUNTIES.

#### Swansea Metal Trades

The tone of the tin-plate market is better, and prices have an upward tendency. Rather more business is passing.

#### Ebbw Vale Dispute.

Steps towards a resumption of work have now been taken, though it is likely to be some days before a restart will be made. The secretary of the South Wales Miners' Federation has received a letter from the general manager of the Ebbw Vale Company, stating that the latter is prepared, as it always has been, to accept Dr. Galloway's award and to put it into operation. Accordingly, the management will meet the representatives of the men at once to discuss certain questions which, under the award, are to be discussed between the parties, and if at that meeting there are any differences of opinion as to the meaning of the award Dr. Galloway is to be called in to decide them. The company will, after such decision, be prepared to reopen the collieries on receiving a guarantee from the Federation and the local representatives of the men at Ebbw Vale that the award will be accepted and worked upon by the men and upon an undertaking signed by the same parties that there will be continuity of work at the collieries and at the by-product works.

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

Mr. H. V. Carrington informs us that he has removed his offices from 64, Victoria-street, London, S.W. 1, to 28, Victoria-street, Westminster, London, S.W. 1.

We are informed that Vaughan and Dymond, Limited, Milburn House, Newcastle-on-Tyne, have become the sole selling agents in North-East Counties for the products of Klinger Patents, 40, King-street, W.C. 2.

Mr. Robert Bell, who recently severed his connection with the United States Shipping Board, of which he was principal Engineer Superintendent in Scandinavia and Germany, asks us to announce that he has commenced business as a consulting engineer and agent for engineering specialities at 73, Drury-buildings, Water-street, Liverpool.

On the recommendation of the Committee of Management of "Science Abstracts," the Council of the Institution of Electrical Engineers has appointed Mr. W. R. Cooper, M.A., B.Sc., M.I.E.E., to be editor of the publication in the place of the late Mr. L. H. Walter. It will be within the recollection of many that Mr. Cooper was acting editor of "Science Abstracts" in the first year of its existence, 1898, and subsequently was editor from 1899 to 1901.

In their search for means of using their huge factories, Sir W. G. Armstrong, Whitworth and Co., Limited, have now taken up the manufacture of steam and oil road rollers and other road-making machinery, including drying and mixing plants. The steam rollers are being manufactured at the Openshaw Works, Manchester. The firm, it may be recalled, is associated with the Partington Steel and Iron Company, Limited, which is now supplying tar slag macadam for road construction throughout the country.

The Institution of Civil Engineers.—It is announced that H.R.H. the Duke of Connaught has consented to unveil the Roll of Honour which has been erected at the Institution of Civil Engineers to the memory of the members and students who lost their lives in the war. The ceremony will take place at 4 p.m. on Friday, October 27th.

Lantern Slides.—Meldrums Limited, Timperley, near Manchester, inform us that they will be pleased to be of assistance to lecturers wishing to give papers on boiler firing. They have a comprehensive set of lantern slides of their forced draught furnaces and mechanical stokers which they will lend free of charge. They have also much data that might be useful in the preparation of papers.

A Gas Economy Valve.—We have received from Mr. Geo. Wilkinson, of Beech Mount, Otley-road, Harrogate, some particulars of a new thermostatic valve for regulating the supply of gas to heating stoves, &c. It is said to contain no leather or other perishable material, and is produced by a die-casting process. The valve is apparently capable of maintaining a steady temperature within a very few degrees.

A Water Waste Preventer.—A new form of water fountain for use in tropical climates or any district where it is important to prevent the waste of water by taps being left running has just been brought out by Guest and Chrimes, Limited, of Rotherham. It takes the form of a chamber in which a constant level of water is maintained by a ball cock. A rocking dipper is arranged in this chamber, and has a discharge through its axis. The whole contrivance is enclosed, with a screwed-down cover, and the dipper is operated by an exterior crank handle. Water can only be obtained a dipper-full at a time, and a continuous flow cannot happen so long as the ball cock is in order. The fountain is being made in two sizes, for delivering 1½ or ¾ gallon at each operation.

Engineering Golfing Society.—The annual autumn meeting of the Engineering Golfing Society was held on the course of the Northwood Golf Club on Tuesday last, the 10th inst., and was a success in every way. There were fifty competitors. In the morning there was an 18-hole medal round for the "Hele-Shaw" Challenge Cup and other prizes. The challenge cup and memento were won by Mr. A. J. Boyd with a scratch score of 83. In the handicap the first prize in the First Division—handicaps up to 10—was won by Mr. J. B. Marr with a score of 87 – 7 = 80, the second prize being taken by Mr. E. C. MacKellar, with 85 – 5 = 80. In the second division—handicaps 11 to 18—the first prize went to Mr. W. L. Mansergh, with 90 – 12 = 78, and the second prize to Mr. C. S. Davidson, with 91 – 12 = 79. The prizes for the best nine holes were won, as for the first nine holes, by Mr. W. R. Manning, and as for the second nine holes, by Mr. P. B. Brown. In the afternoon there were foursomes—18-hole match play against Bogey—in which the "Hadfield" Challenge Cups and Mementoes were won by Messrs. C. R. D. Pritchett and E. W. Timmis and the second prizes by Messrs. G. Midgley Taylor and H. G. Hale. As usual the arrangements were excellent and reflected great credit on the Hon. Secretary and his assistant. The meeting went without a single hitch.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. Coast— | |
| Native | 22/6 |
| (1) Spanish | 22/6 |
| (1) N. African | 22/6 |
| N.E. Coast— | |
| Native | — |
| Foreign (c.i.f.) | 23/- |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) Scotland— | | |
| Hematite | 5 7 6 | — |
| No. 1 Foundry | 5 5 0 | — |
| No. 3 Foundry | 5 0 0 | — |
| N.E. Coast— | | |
| Hematite Mixed Nos. | 4 12 0 | 4 12 0 |
| No. 1 | 4 12 6 | 4 12 6 |
| Cleveland— | | |
| No. 1 | 4 17 6 | 4 17 6 |
| Silicious Iron | 4 17 6 | 4 17 6 |
| No. 3 G.M.B. | 4 12 6 | 4 12 6 |
| No. 4 Foundry | 4 10 0 | 4 10 0 |
| No. 4 Forge | 4 5 0 | 4 5 0 |
| Mottled | 4 0 0 | 4 0 0 |
| White | 4 0 0 | 4 0 0 |
| Midlands— | | |
| (3) Staffs.— | | |
| All-mine (Cold Blast) | 13 0 0 | — |
| North Staffs. Forge | 3 12 6 | — |
| ,, ,, Foundry | 4 4 0 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 4 0 0 | — |
| ,, Forge | 3 10 0 | — |
| (3) Derbyshire— | | |
| No. 3 Foundry | 4 2 6 to 4 3 6 | |
| Forge | 3 17 6 | — |
| (3) Lincolnshire— | | |
| Basic | 4 6 6 | — |
| Foundry | 4 6 6 | — |
| Forge | 4 6 6 | — |
| (4) N.W. Coast— | | |
| N. Lancs. and Cum. | | |
| Hematite Mixed Nos. | 5 5 0 | — |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| Scotland— | | |
| Crown Bars | 10 10 0 | 10 10 0 |
| Best ,, | 12 0 0 | — |
| N.E. Coast— | | |
| Crown Bars | 11 0 0 | — |
| Tees | 10 0 0 | — |
| Lancs.— | | |
| Crown Bars | 11 10 0 | — |
| Second Quality Bars | 10 5 0 | — |
| Hoops | 14 0 0 | 13 15 0 |
| S. Yorks.— | | |
| Crown Bars | 12 0 0 | — |
| Best ,, | 12 10 0 | — |
| Hoops | 14 0 0 | — |
| Midlands— | | |
| Crown Bars | 10 10 0 to 11 5 0 | |
| Marked Bars (Staffs.) | 13 10 0 | — |
| Nut and Bolt Bars | 9 15 0 to 9 17 6 | |
| Gas Tube Strip | 11 0 0 | — |

## STEEL.

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) Scotland— | | |
| Boiler Plates | 12 10 0 | — |
| Ship Plates ½in. and up | 9 0 0 | — |
| Sections | 8 15 0 | — |
| Steel Sheets ⅛in. to ½in. | 10 5 0 | — |
| Sheets (Gal. Cor. 24 B.G.) | — | 17 12 6 |

## STEEL (*continued*)

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. Coast— | | |
| Ship Plates | 9 0 0 to 9 10 0 | — |
| Angles | 8 15 0 to 9 0 0 | — |
| Boiler Plates | 12 10 0 | — |
| Joists | 9 0 0 | — |
| Heavy Rails | 9 10 0 | — |
| Fish-plates | 14 10 0 | — |
| Channels | 13 10 0 | — |
| Hard Billets | 8 5 0 | — |
| Soft Billets | 7 10 0 | — |
| N.W. Coast— | | |
| Barrow— | | |
| Heavy Rails | 9 10 0 | — |
| Light ,, | 11 0 0 to 13 0 0 | |
| Billets | 9 5 0 | — |
| Manchester— | | |
| Bars (Round) | 9 0 0 to 9 10 0 | |
| ,, (others) | 9 10 0 to 10 0 0 | |
| Hoops (Best) | 15 5 0 | 15 0 0 |
| ,, (Soft Steel) | 12 5 0 | 12 0 0 |
| Plates | 9 0 0 to 10 0 | |
| ,, (Lancs. Boiler) | 13 10 0 | — |
| Sheffield— | | |
| Siemens Acid Billets | 10 0 0 | — |
| Bessemer Billets | 12 10 0 | — |
| Hard Basic | 8 5 0 | — |
| Soft ,, | 7 5 0 | — |
| Hoops | 11 15 0 | — |
| Soft Wire Rods | 10 0 0 | — |
| Midlands— | | |
| Small Rolled Bars | 9 0 0 to 9 10 0 | |
| Billets and Sheet-bars | 7 0 0 to 7 2 6 | |
| Gas Tube Strip | 10 0 0 to 10 5 0 | |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | |
| Galv. Sheets (f.o.b. L'pool) | 16 7 6 to 16 12 6 | |
| Angles | 8 15 0 to 9 0 0 | |
| Joists | 9 0 0 to 9 10 0 | |
| Tees | 10 0 0 | — |
| Bridge and Tank Plates | 9 0 0 to 9 10 0 | |

## NON-FERROUS METALS.

| | |
|---|---|
| Swansea— | |
| Tin-plates, I.C., 20 by 14 | 18/9 to 19/- |
| Block Tin (cash) | 165 2 6 |
| ,, (three months) | 166 5 0 |
| Copper (cash) | 63 0 0 |
| ,, (three months) | 63 12 6 |
| Spanish Lead (cash) | 25 5 0 |
| ,, (three months) | 24 5 0 |
| Spelter (cash) | 32 17 6 |
| ,, (three months) | 32 5 0 |
| Manchester— | |
| Copper, Best Selected Ingots | 67 10 0 |
| ,, Electrolytic | 72 10 0 |
| ,, Strong Sheets | 96 0 0 |
| ,, Loco Tubes | 0 1 1½ |
| Brass Loco Tubes | 0 0 11½ |
| ,, Condenser | 0 1 2½ |
| Lead, English | 26 10 0 |
| ,, Foreign | 25 7 6 |

## FERRO ALLOYS.

*(All prices now nominal.)*

| | Per Ton. | Per Unit |
|---|---|---|
| Tungsten Metal Powder | 1/11 per lb. | |
| Ferro Tungsten | 1/5 per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £30 | 12/- |
| ,, 6 p.c. to 8 p.c. ,, | £22 10 0 | 9/- |
| ,, 8 p.c. to 10 p.c. ,, | £21 10 0 | 8/- |
| ,, Specially Refined | | |
| ,, Max. 2 p.c. carbon | £55 0 0 | 26/- |
| ,, ,, 1 p.c. ,, | £68 0 0 | 30/- |
| ,, ,, 0·75 p.c. carbon | £75 0 0 | 37/- |
| ,, carbon free | 1/7 per lb. | |
| Metallic Chromium | 5/- per lb. | |
| Ferro Manganese (per ton) | £15 for home. | |
| ,, Silicon, 45 p.c. to 50 p.c. | £12 0 0 scale 5/- per unit | |
| ,, ,, 75 p.c. | 20 10 0 scale 6/- per unit | |
| ,, Vanadium | 17/- per lb. | |
| ,, Molybdenum | 8/- per lb. | |
| ,, Titanium (carbon free) | 1/2 per lb. | |
| Nickel (per ton) | £160 | |
| Cobalt | 11/- per lb. | |
| Aluminium (per ton) | £82 to £100 (British Official.) | |

## FUELS.

### SCOTLAND.

| | | Export. |
|---|---|---|
| Lanarkshire— | | |
| (f.o.b. Glasgow)—Steam | | 22/- |
| ,, ,, Ell | | 23/- |
| ,, ,, Splint | | 23/- to 24/- |
| ,, ,, Trebles | | 23/6 |
| ,, ,, Doubles | | 22/- |
| ,, ,, Singles | | 19/6 |
| Ayrshire— | | |
| (f.o.b. Ports)—Steam | | 22/- |
| ,, ,, Splint | | 23/- |
| ,, ,, Trebles | | 23/6 |
| Fifeshire— | | |
| (f.o.b. Methil or Burntisland)—Steam | | 21/- to 25/- |
| Screened Navigation | | 23/- |
| Trebles | | 23/9 |
| Doubles | | 22/9 |
| Singles | | 20/6 |
| Lothians— | | |
| (f.o.b. Leith)—Best Steam | | 23/- |
| Secondary Steam | | 22/6 |
| Trebles | | 23/6 |
| Doubles | | 22/9 |
| Singles | | 20/9 |

### ENGLAND.

| | |
|---|---|
| (8) N.W. Coast— | |
| Steams | 49/6 |
| Household | 46/8 to 57/6 |
| Coke | 34/- |
| Northumberland— | |
| Best Steams | 25/- to 26/- |
| Second Steams | 23/6 to 24/6 |
| Steam Smalls | 15/- to 16/6 |
| Unscreened | 20/6 |
| Household | 25/- to 28/- |
| Durham— | |
| Best Gas | 24/- to 24/6 |
| Second | 22/- to 22/6 |
| Household | 25/- to 28/- |
| Foundry Coke | 37/- to 40/- |

| Sheffield— | Inland. |
|---|---|
| Best Hand-picked Branch | 32/6 to 34/6 — |
| Barnsley Best Silkstone | 28/- to 30/- — |
| Derbyshire Best Brights | 24/- to 25/- — |
| ,, ,, House | 21/6 to 22/6 — |
| ,, ,, Large Nuts | 18/6 to 20/6 — |
| ,, ,, Small ,, | 15/- to 16/6 — |
| Yorkshire Hards | 20/- to 21/- — |
| Derbyshire ,, | 19/- to 20/6 — |
| Rough Slacks | 8/6 to 10/6 — |
| Nutty ,, | 7/6 to 8/6 — |
| Smalls | 3/- to 5/- — |
| Blast Furnace Coke (Inland and Export) | 21/- to 30/- |

### (9) SOUTH WALES.

| | |
|---|---|
| Cardiff— Steam Coals: | |
| Best Smokeless Large | 27/6 to 28/- |
| Second ,, ,, | 26/- to 27/- |
| Best Dry Large | 28/- to 28/6 |
| Ordinary Dry Large | 27/6 to 28/- |
| Best Black Vein Large | 25/ to 25/6 |
| Western Valley ,, | 24/6 to 25/6 |
| Best Eastern Valley Large | 24/- to 25/- |
| Ordinary ,, ,, | 22/6 to 24/- |
| Best Steam Smalls | 16/- to 16/6 |
| Ordinary ,, | 12/- to 14/- |
| Washed Nuts | 25/- to 30/- |
| No. 3 Rhondda Large | 28/- to 29/- |
| ,, ,, Smalls | 18/- to 19/- |
| No. 2 ,, Large | 22/- to 23/- |
| ,, ,, Through | 18/6 to 19/6 |
| ,, ,, Smalls | 12/- to 14/- |
| Coke (export) | 35/- to 40/- |
| Patent Fuel | 26/6 to 28/6 |
| Pitwood (ex ship) | 27/- to 28/- |
| Swansea— Anthracite Coals: | |
| Best Big Vein Large | 52/6 to 55/- |
| Seconds | 45/- to 47/6 |
| Red Vein | 37/6 to 42/6 |
| Machine-made Cobbles | 65/ to 70/- |
| Nuts | 70/- to 72/6 |
| Beans | 45/- to 47/6 |
| Peas | 23/- to 24/- |
| Breaker Duff | 8/6 to 9/- |
| Rubbly Culm | 13/6 to 14/- |
| Steam Coals: | |
| Large | 25/- to 27/6 |
| Seconds | 24/- to 25/- |
| Smalls | 14/6 to 16/- |
| Cargo Through | 19/6 to 22/6 |

(1) Delivered. (2) Net Makers' works. (3) At furnaces. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England (7) Export Prices—F.O.B. Glasgow.

(8) Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b.

# French Engineering Notes.

*(From our Correspondent in Paris.)*

### Liquid Fuels.

THE policy which was adopted soon after the Armistice of organising a scientific inquiry into the production of fuels which would relieve the country of its dependence upon imported oils has already given definite results, and it is hoped that further solutions of the problem will be offered at the Congress on Liquid Fuels now being held in Paris, where the whole subject is being discussed. So far as the practical application of home-produced fuels is concerned, little has been done beyond the successful employment of a mixture of petrol and benzol on the Paris motor omnibuses. The vehicles were running with this mixture in equal proportions for some years before the war with perfectly satisfactory results, but it was far from being a "national fuel," since the quantity of benzol produced in this country represents only a small proportion of the total consumption. Experiments are now being carried out with various fuel combinations, notably a half mixture of benzol and alcohol, but it is found that with 90 per cent. alcohol there is trouble due to the pitting of cylinder walls and the rusting of pipes. These troubles are avoided by partly dehydrating the alcohol to 95 per cent., although, as a precaution, copper pipes are used. At the Liquid Fuel Exhibition on the Esplanade des Invalides omnibus engines are being run on various mixtures, notably alcohol 45 per cent., petrol 45 per cent., and ether 10 per cent. There seems to be little hope at the moment of producing national fuels in sufficient quantities to suit all requirements, and the only thing to be done is to combine fuels so as to utilise as many as possible.

### Street Paving.

After being entirely neglected during the war, the streets of Paris were in so deplorable a condition that the problem of repairs was a very serious one for the Municipal Council, which could do nothing for want of funds, and it was only when the raising of the public loan last year allowed of the Council devoting several million francs to street repairs that it was possible to make arrangements for carrying out the work. Except in extensive spaces like the Place de la Concorde, where the re-paving could be undertaken without seriously interfering with the traffic, it was decided to repair the roads during the summer months when the circulation of vehicles is not very active. It was announced that the whole of the work would be completed by the winter. This could only be done by starting work simultaneously in many of the leading thoroughfares, and, unfortunately, the Council could hardly have foreseen the difficulties that would be encountered in procuring material in sufficient quantities, and especially in getting an adequate supply of skilled labour. The difficulties have been further increased by the new Metropolitan extension works, and by the relaying of tramway lines. On account of the magnitude of the task, the work has not been carried out fast enough to satisfy the impatience of Parisians, and comparisons have frequently been made between the methods adopted in Paris and London, where the re-paving is largely done at night. The shortness of skilled labour has not allowed of this being done in Paris, and under the circumstances the work has been carried out as expeditiously as could be expected. Nevertheless, it is certain that time would be saved by organising a better service with the tramways, so that when lines are relaid it will not be necessary to pave the roads piecemeal, and then afterwards to pull them up for final repairs. It is also remarked that the new roads are not wearing well. This is attributed partly to the fact that they had to be opened for traffic before the surface had time to dry. The most serious cause of wear and tear is the heavy traffic, and more especially the motor omnibuses, and experiments are now being made with pneumatic tires on the latter.

### Inventions.

There has always been an impression that this country is the one where inventive talent is the most prolific and the least encouraged, to the extent that many valuable inventions have to be developed abroad through lack of enterprise in taking them up at home. It is now argued that if a country is to make headway in scientific development and in the industrial arts, it can only be done by utilising this talent, and one of the objects of the Comité des Recherches et Inventions, which was constituted by the Government and endowed with a laboratory at Meudon, near Paris, is to investigate new ideas that may be presented and develop them if found to be of sufficient promise, the expenses being covered by a percentage of what is paid for the invention in the event of its commercial and industrial realisation. The work of the Committee is, however, so limited by the smallness of the funds available that one of the Paris journals is coming to its assistance by offering prizes for the most useful and valuable inventions presented during the coming year. It is hoped by this means to provide science and industry with new elements of progress that would otherwise lie dormant for want of encouragement.

### Coefficients.

The proposed new scale of coefficients has been presented by the Customs Department to the Minister of Commerce, who has submitted them to the various industrial groups with a view of seeing if they fall in with the requirements of the home industry. It is understood that the coefficients—that is to say, the factors by which the pre-war import duties are multiplied ostensibly to bring them level with currency values of to-day—have been reduced so far as concerns raw and semi-manufactured products, but for manufactured goods there are increases in some cases and diminutions in others, the average showing probably a notable augmentation, although to nothing like the extent claimed by the manufacturing interests. In the iron and steel trades, for example, the sheet makers are asking for higher coefficients on the ground that the cost of transport by water from Belgium to the south-west of France is less than the railway charges from the eastern departments.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

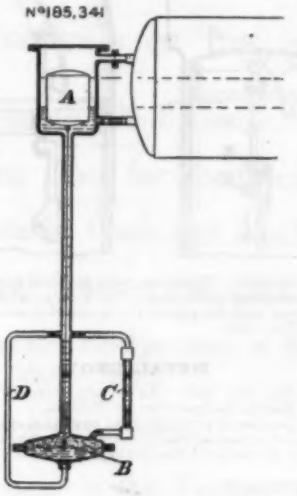
*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

## STEAM GENERATORS.

185,341. October 12th, 1921.—WATER LEVEL GAUGES, *Babcock and Wilcox, Limited*, 30, *Farringdon-street, London, E.C.*

THIS gauge glass is intended to show the water level of high boilers at a lower position more convenient for reading. A float A, in a chamber communicating with the boiler drum, is connected with a diaphragm B in a lower chamber. Above the diaphragm




there is some heavy liquid, such as mercury, the changes in level of which are indicated in the glass C. A connection D is provided to put the two sides of the diaphragm in equilibrium as regards steam pressure.—*September 7th*, 1922.

## SWITCHGEAR.

185,271. July 2nd, 1921.—OUTDOOR SWITCHGEAR, C. W. Kay and Callender's Cable and Construction Company, Limited, Hamilton House, Victoria Embankment, London, E.C. 4.

This is a cheap form of outdoor switch for making tappings off overhead transmission lines. A is a portion of the structure on which the gear is mounted. B are the insulators. C is the choking coil. D is a metallic bar and E a spring contact. F is the switch arm having a blade G at its end, which swings on the pivot L to engage with the contact E. The switch arm F is operated from the ground by means of a long arm H pivoted on a bearing J. This long arm is connected to the switch arm F by means of an insulated bar K, which is attached to the switch arm F by the hinge M, and to the long arm H by the hinge N, which is mounted on insulator P. To obtain the necessary alignment between the switch arm blade and the jaws of the switch

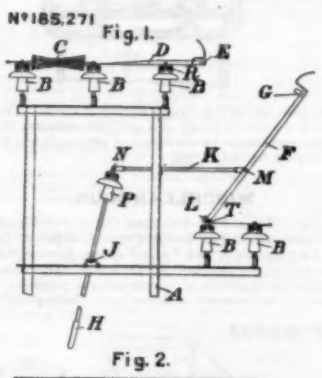
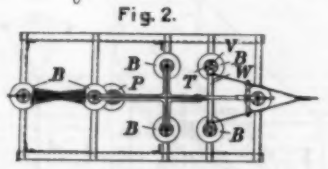


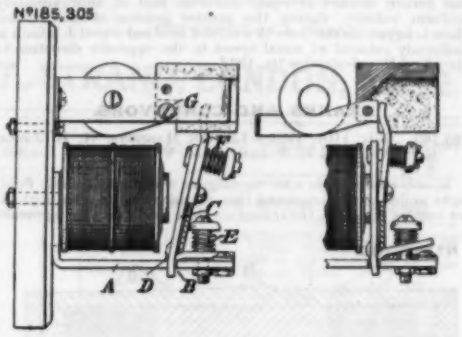

Fig. 2.




contact metallic caps R are mounted on the top of the insulators B, these caps being screwed to the insulators so that vertical adjustment is obtainable in all cases. The two insulators B which carry the switch arm both have a metallic boss T attached to the top of the caps, and between the two bosses the base W of the switch arm is pivoted. The switch arm is so pivoted that horizontal adjustment is obtainable, and this is provided for by fitting pointed set screws V in each of the bosses T, the points protruding through the bosses and engaging with countersunk holes formed in the two sides of the base W of the switch arm. With this arrangement it will be seen that by screwing back one set screw and screwing forward the other the position of the switch arm may be adjusted in a horizontal direction. With the horizontal adjustment permitted on the switch arm the vertical adjustment permitted both on the arm and on the contact jaws, and the rocking adjustment due to the three-point suspension, proper alignment can be obtained even where big air breaks are required on extra high-tension transmission lines.—*September 7th*, 1922.

185,305. August 3rd, 1921.—ELECTRO-MAGNETIC SWITCHES, *The British Thomson-Houston Company, Limited*, 83, *Cannon-street, London, E.C.* 4.

The object of the inventors has been to devise a form of electro-magnetic switch which will be cheap to manufacture. The magnet frame A is a stamping having two notches at B, which serve as recesses for horns on the end of the armature C. The armature also has a central bent-up part that provides a rounded corner

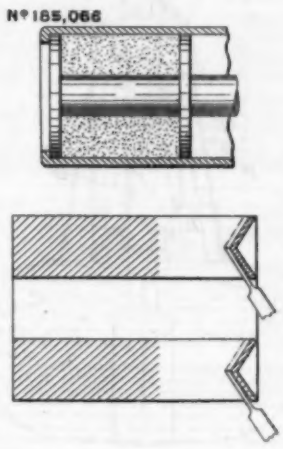



at D on which it can rock and also serves as an abutment for the spring E used to keep the switch open. A spring contact finger F is provided to act in conjunction with the fixed contact G, which is formed as a single-turn coil to act as a magnetic blow-out. The switch is shown open in the left-hand drawing and closed on the right.—*September 7th*, 1922.

## TRANSMISSION OF POWER.

185,066. June 29th, 1921.—FRICTION DISCS AND BRAKE LININGS, "Scandinavia" Belting, Limited, 59, Southwark-street, London; A. M. Fenton, Northcliffe, Cleckheaton; and T. H. Crowther, Prospect Villas, Cleckheaton.

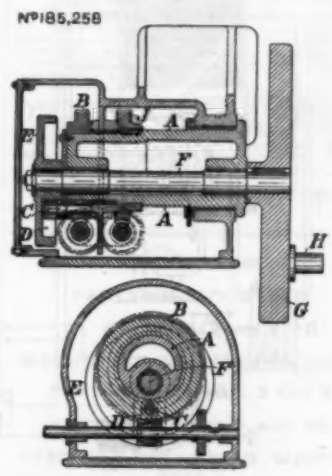
Friction discs for clutches, brake linings, &c., are made, according to this invention, by winding yarn of cotton, ramie, flax, silk, wool, asbestos or similar fibrous material on to a bobbin, preferably of a diameter corresponding with that of the




inner diameter desired for the washer, and the winding is continued until it corresponds with that desired for the outer diameter of the said washer. The yarn is preferably passed through a bath containing a solution of india-rubber, gutta-percha or balata, or a mixture of phenol and formaldehyde with a catalytic agent, or a viscous product of the reaction of such materials. The spool is then compressed, baked and cut up into the desired form. The drawings are self-explanatory.—*August 31st*, 1922.

185,258. June 21st, 1921.—CONVERTING ROTARY INTO RECIPROCATING MOTION, T. Lumsden, The Lumsden Machine Company, Limited, Alexandra Works, Gateshead-on-Tyne.

The object of this invention is to provide a mechanism whereby the uniform rotation of a shaft is converted into approximately uniform rectilinear reciprocation during the greater portion of each stroke, the acceleration and retardation of the reciprocating member being mainly confined to the end portions of each stroke. The mechanism of the present invention is of the kind known as the Whitworth quick-return motion. A is a



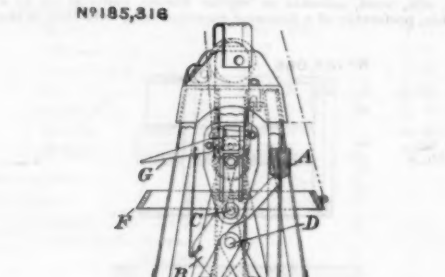

boss on which the toothed wheel B is loosely mounted and free to rotate. C is the pin on the toothed wheel B which engages a slot D in the member E and rotates that member about the axis of a shaft F which is equivalent to the eccentric pin on the boss of the Whitworth motion. The member E is keyed to the shaft F and its rotation is transmitted thereby to a crank disc G having a crank pin H, to which one end of the connecting-rod—not shown—is pivoted. If both the axis of the toothed wheel B

and the axis of the shaft F are stationary, the mechanism constitutes a Whitworth quick-return motion and will convert uniform rotation of the toothed wheel B into a slow forward stroke and quick-return stroke of the crosshead driven by the connecting-rod attached to the crank pin H. To obtain forward and return strokes of equal duration and of approximately uniform velocity during the greater portion of each stroke, there is keyed to the boss A a second toothed wheel J, which is uniformly rotated at equal speed in the opposite direction to the wheel B.—*September 7th*, 1922.

## CRANES AND CONVEYORS.

185,280. July 11th, 1921.—Lifting Magnets, H. R. Jones, C. E. Wood and W. E. Lawton, 56, Victoria-street, London, S.W.

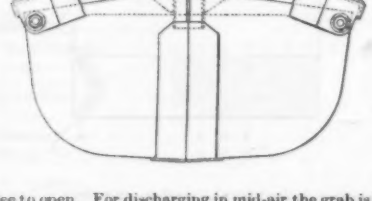
In order to provide a lifting magnet which may remain fluid-tight under rough usage and thus permit it being filled with oil for cooling purposes, the inventors close the lower face by means




of a plate A of non-magnetic steel, which is either cast in place or fixed by autogenous welding. A bolted-on cover B is provided at the top for the insertion of the winding.—*September 7th*, 1922.

185,316. August 22nd, 1921.—Grabs, G. J. Hone, Margery Hall, Margery Park-road, Forest Gate, London, and J. Westwood and Co., Limited, Napier Yard, Millwall.

With this grab it is possible to discharge the load either on contact with the ground or in mid-air. For the former purpose the sliding weight A rocks the hook B about its pivot C and disengages it from the cross bar D of the links E. The buckets are

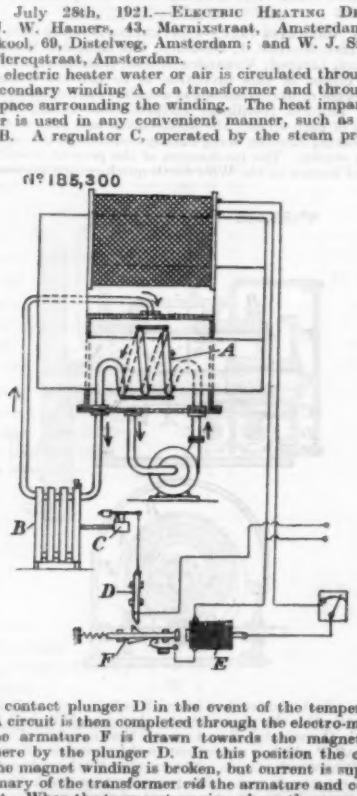



then free to open. For discharging in mid-air the grab is hoisted up through the ring F hanging from the crane jib and then lowered again slightly. The trigger G catches the ring and pulls the hook B clear of the cross bar.—*September 7th*, 1922.

## LIGHTING AND HEATING.

185,300. July 28th, 1921.—Electric Heating Devices, H. J. W. Hamers, 43, Marnixstraat, Amsterdam; M. Buiskool, 69, Distelweg, Amsterdam; and W. J. Sillman, 52, Clereqstraat, Amsterdam.

In this electric heater water or air is circulated through the hollow secondary winding A of a transformer and through the annular space surrounding the winding. The heat imparted to this water is used in any convenient manner, such as in the radiator B. A regulator C, operated by the steam pressure,

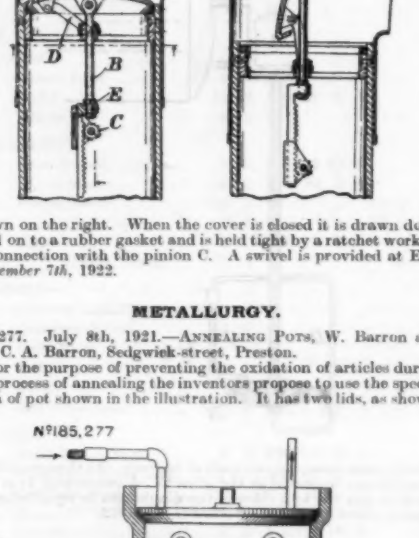



drops the contact plunger D in the event of the temperature falling. A circuit is then completed through the electro-magnet E and the armature F is drawn towards the magnet and latched there by the plunger D. In this position the circuit through the magnet winding is broken, but current is supplied to the primary of the transformer *via* the armature and core of the magnet. When the temperature rises above the normal the regulator lifts the plunger D and both circuits are broken.—*September 7th*, 1922.

## SHIPS AND BOATS.

185,352. November 23rd, 1921.—Ships' Ventilators, J. F. Swanberg, 130th and Greenwood-avenue, Seattle, Washington.

This ventilator can be closed by means of the cover A, which is pivoted on the top of the post B. When the post is raised by means of the rack and pinion C, one side of the cover is held down by the link D, and it is thus tilted into the open position, as

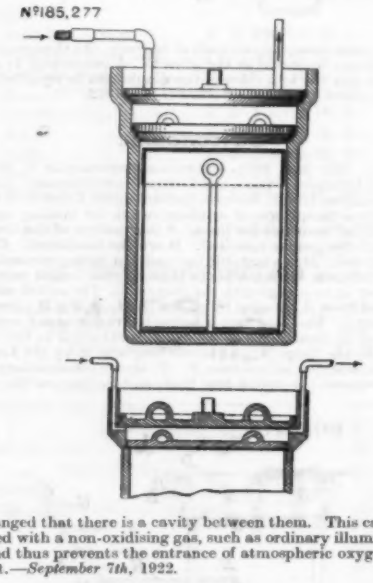



shown on the right. When the cover is closed it is drawn down hard on to a rubber gasket and is held tight by a ratchet working in connection with the pinion C. A swivel is provided at E.—*September 7th*, 1922.

## METALLURGY.

185,277. July 8th, 1921.—Annealing Pots, W. Barron and C. A. Barron, Sedgwick-street, Preston.

For the purpose of preventing the oxidation of articles during the process of annealing the inventors propose to use the special form of pot shown in the illustration. It has two lids, as shown.

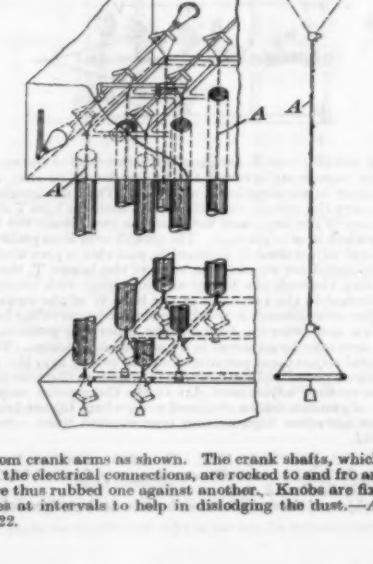



so arranged that there is a cavity between them. This cavity is supplied with a non-oxidising gas, such as ordinary illuminating gas, and thus prevents the entrance of atmospheric oxygen into the pot.—*September 7th*, 1922.

## MISCELLANEOUS.

184,959. July 4th, 1921.—Shaking Gear for Electrostatic Dust Catchers, *The Lodge Fume Company, Limited*, 51, *Great Charles-street, and Church-street, Birmingham.*

In order to remove the dust which would otherwise adhere to the discharge electrodes of electrostatic gas purifiers, the inventors use two or more wires A A for each electrode and suspend




them from crank arms as shown. The crank shafts, which provide for the electrical connections, are rocked to and fro and the wires are thus rubbed one against another. Knobs are fixed on the wires at intervals to help in dislodging the dust.—*August 31st*, 1922.

# Forthcoming Engagements.

*Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

The Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Paper, "Artificial Icemaking," by Mr. E. C. West. Slides. 7.30 p.m.

The Institute of Metals: Sheffield Local Section.—Mappin Hall, St. George's-square, Sheffield. Postponed annual meeting. Paper, "Non-ferrous Foundry Practice," by Mr. P. Longmuir. 7.30 p.m.

West of Scotland Iron and Steel Institute.—Room 24, Royal Technical College, George-street, Glasgow.—Opening meeting. Presidential address by Mr. E. H. Lewis. Paper, "A New Refractory Material," by Mr. Walter Smith. 7 p.m.

SATURDAY, OCTOBER 14th.

Keighley Association of Engineers.—The Canteen, Burlington Shed Works. Lecture, "Some Points Relating to the Theory and Construction of Oil Engines," by Professor W. H. Watkinson. 6.30 p.m.

MONDAY, OCTOBER 16th.

Bradford Engineering Society.—The Technical College, Bradford. Lecture, "The Still System of Internal Combustion Engine," by Mr. H. A. D. Acland. 7.30 p.m.

The Institution of Automobile Engineers: Scottish Centre.—The Royal Technical College, Glasgow. Presidential address by Lieut.-Colonel D. J. Smith. 7.30 p.m.

MONDAY to WEDNESDAY, OCTOBER 16th to 18th.

British Commercial Gas Association.—Eleventh annual conference. Lecture Theatre of the Museum and Art Gallery, Bristol. For programme see page 366.

TUESDAY, OCTOBER 17th.

The Institute of Transport.—The Institution of Electrical Engineers, Savoy-place, W.C. 2. Extraordinary general meeting. 5.30 p.m.

WEDNESDAY, OCTOBER 18th.

The Institute of Physics.—The Institution of Electrical Engineers, Savoy-place, Victoria Embankment, W.C. 2. Lecture, "The Physicist in Electrical Engineering," by Mr. C. C. Paterson. 6 p.m.

The Institution of Automobile Engineers: North of England Centre.—Education Offices, Salford, Manchester. Paper, "The Light Car and Motor Cycle and Sidecar Compared," by Mr. W. H. Hingston. 7.30 p.m.

Institution of Automobile Engineers: Birmingham Centre.—The Chamber of Commerce, New-street, Birmingham. Debate, "Cycle Car *versus* Motor Cycle and Sidecar." 7.30 p.m.

THURSDAY, OCTOBER 19th.

The Institution of Mining and Metallurgy.—Cleveland House, 225, City-road, E.C. 1. General meeting.

Institution of Automobile Engineers.—28, Victoria-street, S.W. 1. Meeting of the London Graduates. Paper, "Motor Car Testing," by Mr. D. S. D. Williams. 8 p.m.

The Institution of Mechanical Engineers.—Hotel Cecil, Strand. Reception and dance. Decorations will not be worn. 8 p.m.

Institution of Locomotive Engineers: Manchester Centre.—Visit to the London and North-Western Railway School of Signalling and the Control Office, Victoria Station, Manchester. 4 p.m. at the entrance to the goods manager's office.

Institution of Locomotive Engineers: Manchester Centre.—College of Technology, Sackville-street, Manchester. Presidential address by Mr. R. H. Whitelegg. 6.30 p.m.

Royal Aeronautical Society.—Royal United Service Institution, Whitehall, S.W. 1. "The Metal Construction of Aeroplanes," by Mr. J. D. North. 5.30 p.m.

FRIDAY, OCTOBER 20th.

Institution of Production Engineers.—Royal Automobile Club, Pall Mall, S.W. 1. Annual general meeting. Presidential address by Mr. M. R. Lawrence. 7.30 p.m.

The Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, S.W. 1. General meeting. Presidential address by Dr. H. S. Hele-Shaw. 6 p.m.

The Junior Institution of Engineers.—39, Victoria-street, Westminster, S.W. 1. Lecturette, "Profits from Waste Products," by Mr. G. H. Ayres. 7.30 p.m.

Keighley Association of Engineers.—Devonshire Hall, Keighley. Social evening. Tickets, inclusive of supper, 3s. 3d. 7 p.m.

MONDAY, OCTOBER 23rd.

The Institution of Mechanical Engineers: Graduates' Section.—Storey's Gate, St. James's Park, S.W. 1. Paper, "Some Factors in the Design of Steam Locomotives," by Mr. R. D. Gauld. 7 p.m.

Institution of Automobile Engineers: Loughborough Centre.—The College, Loughborough. Paper, "Gear Ratios, with special reference to Epicyclic Train," by Mr. J. Bedford. 7 p.m.

TUESDAY, OCTOBER 24th.

The Institution of Automobile Engineers: Coventry Centre.—The Railway Hotel, Coventry. Paper, "The Light Car and Motor Cycle and Sidecar Compared," by Mr. W. H. Hingston. 7.30 p.m.

The Institute of Marine Engineers.—85–88, The Minories, Tower Hill, E. 1. Views illustrating industrial works, Messrs. Bruce Peebles. Ladies' night. 6.30 p.m.

Institution of Engineers and Shipbuilders in Scotland.—Rankine Hall, 39, Elmbank-crescent, Glasgow. Opening meeting. 7.30 p.m.

WEDNESDAY, OCTOBER 25th.

Institution of Automobile Engineers.—Connaught Rooms, Great Queen-street, W.C. 2. Annual dinner. 7.30 p.m.

FRIDAY, OCTOBER 27th.

The Institution of Mechanical Engineers.—Storey's Gate, St. James's Park, S.W. 1. Extra General Meeting. Adjourned discussion on the "Use of the Turbo-Compressor for Attaining the Greatest Speeds in Aviation," by Professor Auguste Rateau.